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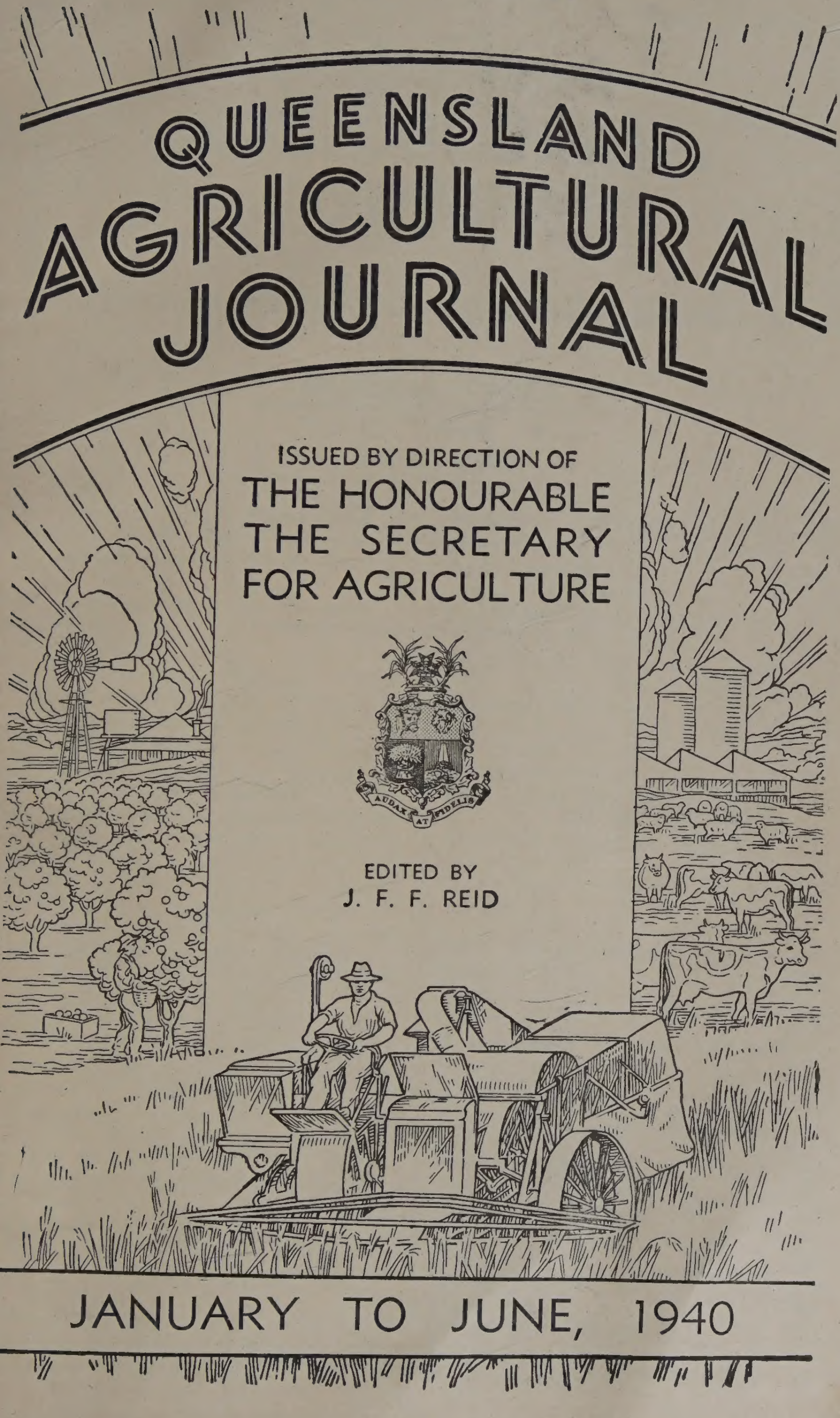

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GENERAL INDEX

PAGE.

A

A Changing Agriculture—Electricity on the Farm 373
A Common Winter Defect in Milk and Cream 397
A Lamb-marking and Blowfly Specific 394
A Native Panic Grass 499
A New Freezing Process 422
A Nutritious Grass 420
A Plant Harmful to Horses .. 420
A Relieving Farmer 245
A Seasonal Reminder to Central Queensland Tomato-growers .. 219
A "Spot" for the Lambing Ewe 248
A Swish of a Tail—and a Tale of a Swish 235
A Tale of a Cow's Tail 121
A Tribute to Australian Butter Quality 421
A Warning against Planting "Misses" with a Second Variety 106
A Wonderful Wheat Yield .. 247
Acid or Base Forming Property of Fertilizers Sold in Queensland 230
Action on the Farming Front .. 513
Agricultural Arithmetic 125
Agricultural Co-ordination .. 264
Agricultural Districts, Rainfall in the, *see* Rainfall.
Agricultural Policy, Britain's War Time 502
Agriculture in War Time 124
Agriculture, War Time, in Britain 595
Animal and Man—Sympathy, not Sentiment 484
Animal Manure 104
Another New Way with Whey .. 120
Another Way to use Whey .. 421
Anzac 431
Apple and Pear Varieties .. 215
Apple Case, Labelling the Export 110
Apples, size of 237
Apply Fertilizers Early 468
Appointment of Mr. Richard P. M. Short as Under Secretary .. 5
Appointments and Staff Changes 236, 336, 418, 498, 588
Arrowroot Board 418
Arsenate of Lead—It's Danger on the Farm 249
Assignments for Cane 116
Astronomical Date for Queensland 132, 262, 346, 430, 512, 608
Australian Council of Agriculture 263

B

Baled Hay or Ensilage 121
Balloon Cotton 240
Bamboo 500
Bamboo Grass 240
Banana Areas, Selecting New .. 580
Banana Levy 116
Banana Rust Control 109
Banana Rust Thrips Control, Substitute Bunch Covers in .. 216
Banana Suckering 333
Bananas in Autumn 330
Bananas, Tending, after Rain .. 581
Bean Fly Control 408
Bean Vine 499
Beans, Early, the Spraying of .. 329
Beans, French 214
Before Winter Comes 321
Berkshires, Prolific 245
Beware of Gas in the Silo 242

PAGE.

- Bloating of Cattle 87
- Blood and Meat Meals 565
- Blood Meal for Dairy Stock 93, 119
- Blowfly Dressing, New, for Sheep 504
- Blowfly Specific, and for Lamb-marking 394
- Blue Grass, Pitted Blue Grass .. 499
- Blue Panic 592
- Boar, Points of a Good 97
- Board—
  - Arrowroot 418
  - Brisbane Milk 229
  - Canary Seed 419, 498
  - Cane Prices, Appointments .. 236
  - Egg 336
  - Honey 418
  - Proposed Tobacco Leaf .. 591
- Bolshevisation of Bees 248
- Botflies in Horses 476
- Bottling the Garden 344
- Bracken 420
- Branding, Careless, Condemned .. 200
- Brands, Faked, Camera Records of 422
- Brazilian Wax Palm 337
- Breeding Horses a National Duty 228
- Breeding Standards 502
- Brie Brie Estate, Mossman, Irrigation Practice on 556
- Brisbane Milk Board .. 229, 419
- Britain the World's Pedigree Stock Farm 422
- Britain's War Time Agricultural Policy 502
- British Farmer and the War .. 247
- British Farmers, Thinking out New Ideas for 504
- British Farmers, War Effort .. 594
- Bruising of Cattle 193
- Buffalo Fly 591
- Bush Fires Prevent—
  - Carelessness Costs Lives and Money 315
- Butter Churns, Something New in 339
- Butter Quality, a tribute to Australian 421
- Buying a Property 348

C

- Cabbage-growing for Market .. 490
- Calf-feeding 320
- Calves, To Check a Bad Habit in 399
- Camera Records of Faked Brands 422
- Canary Seed—
  - Board 419, 498
  - Surplus Production 498
- Candle Nut 118
- Cane Assignments 116

PAGE.

- Cane—
  - Farms, Hay Crops for 562
  - Fields, Control of Rats in Queensland 465
  - Hoist Operated by a Motor Cycle Engine 461
  - New Queensland-bred Seedling 486
  - Prices Board Appointments .. 236
  - Soils, Damage to, by Arsenic .. 113
- Cane-growers—
  - A Warning against Planting "Misses" with a Second Variety 106
- Cape or Balloon Cotton 240
- "Cape Cotton" 500
- Care—
  - of Sick Animals 191
  - of Weaners 400
- Careless Branding Condemned .. 200
- "Carrot Fern" or "Parsley Fern"—Hemlock 240
- Casein for Aeroplanes 248
- Cases, Marking 219
- Cattle—
  - Bloating of 87
  - Bruising of 193
  - "Lumpy Jaw" of 473
  - Redwater in 318
  - The Parasitic Worm Diseases of 136
- Cauliflowers, Marketing 580
- Caustic Vine or Milky Vine .. 337
- Cemented Bags for Light Farm Buildings 212
- Central Coast Stallion District .. 498
- Changing Agriculture—Electricity on the Farm 373
- Charcoal for Pigs 98
- Child and Maternal Welfare 127, 253, 343, 425, 507, 602
- Childhood, The Value of Sleep and Rest in 253
- Churns, An Outsize in 503
- Citrus—
  - Fruit, Handling 492
  - Fruits as a Fertilizer 124
  - Levy 419
  - Trees, Replacement of in Established Orchards 109
  - Trees, Re-working Drone .. 218
- Cleanliness in Cow Bail 396
- Climatological Table 131, 261, 345, 429, 511, 607
- Climbing Buckwheat 241
- Clovers on the Coast 211
- Cluster Clover 592
- Clydesdales Come Back 594
- Cockroach Control 255
- Cold Resistant Sugar Cane .. 559

PAGE.
Comfort for Cows in Winter Weather 399
Common Winter Deficit in Milk and Cream 397
Concentrates and Licks for Dairy Cattle in Winter 94
Control of Rats in Queensland Cane Fields 465
''Coolibah Grass'' 500
Cooling Milk Drinks 259
Cory, Lieutenant-Colonel A. H., P.D., M.R.C.V.S.—In Memorium 239
Cotton Board Election 116
Council of Agriculture 590
Counting Sheep 476
Cow—
  Age and its Effect on Milk .. 479
  Comfort for, in Wintry Weather 399
  Pigs being Divorced from .. 242
  The Temperamental 595
  With Head and Tail Lights for Wartime ''Black-out'' .. 422
Cream—
  Inferior 197
  Marginal 479
  Stirring 198
  Treatment of 244
Crop Rotation 482
Crutching and Jetting 193
Culling the Ewe Flock 90

D

Dairy Cattle—
  Concentrates and Licks in Winter for 94
  Feeding, in Winter 565
Dairy Farmers, ''Don'ts'' and ''Buts'' for 95
Dairy Stock, Blood Meal for 93, 119
Dairying in Great Britain 421
Dairying, Profitable 94
Damage to Cane Soils by Arsenic 113
Deciduous Fruit Tree, How to Plant 489
Dermatitis 91
Desert Poison Bush 118
Dipping Fluids, Use of 475
Dipping Sheep 193
Dirt on the Dishcloth 566
Disinfection 394
Dodder in Lucerne Seed 326
Dog Burr 117
''Don'ts'' and ''Buts'' for Dairy Farmers 95
Dorset Horn Cross for Fat Lambs 422
Drenching Sheep 190
Drought Feeding of Sheep .. 593
Dry Milking is Clean Milking .. 398

PAGE.

E

Early Spring Grass 337
Effect of Climatic Conditions on Different Classes of Poultry .. 325
Effect of War on Rural Industry 515
Egg Board 336, 590
Egg Storage in Oil 248
Eggs—Why They are Small .. 242
Electric Fence, The Effectiveness of 248
Empire and Trade 349
Energy of Growth in Seed Germination 213
Establishing Lucerne 206
Event and Comment 1, 133, 264, 347, 431, 513
Ewe Flock, The Culling of the .. 90
Export Apple Case, Labelling the 110

F

Farm—
  Arsenate of Lead—Its Danger on the 249
  Buildings, Cemented Bags for Light 212
  Equipment, Sales Tax on .. 338
  Notes— 125, 250, 340, 423, 505, 599
  Water Supply 575
  Work for Punishment 120
Farm Kitchen, In the—
  Citrus Fruit Jams 509
  Nourishing Soups 605
  ''Smoko'' Dainties 427
  Summer Salads 258
Farmer, A relieving 245
Farmer, The Young—Interstate Competition 587
Farmer and War 245
Farmer in War Time Britain .. 243
Farmers' Feathered Friends .. 593
Farmers of the Future 488
Farmers Plough for Victory .. 513
Farms as Gilt-edged Securities 594
Farms, Making Full Use of Our 598
Farrowing Sow 322
Fauna Sanctuary near Benaraby 590
Fauna Sanctuary at Mount Morgan 419
Feed Trough on Skids 44
Feeding of Concentrates 478
Feeding—
  Dairy Cattle in Winter 565
  Fowls 405
  Pigs 401
  Scrub to Sheep 89
Fertilizer and Manure 213
Fertilizers, Apply, Early 468

PAGE.

Fertilizers Sold in Queensland, the Acid or Base Forming Property of 230
Fertilizers, Straight, and Their Incorporation into Fertilizing Mixtures 186
Fertilizing for Better Vegetable Crops 421
Fertilizing Practice, A New Point in 248
Filling the Tin Can for Victory 594
Fires, Bush, Prevent—Carelessness Costs Lives and Money .. 315
Flushing the Separator 399
Fodder Conservation in Central Queensland 485
Fodder Conservation on the Downs 453
Fodder Crops, Grow More .. 576
Food Deficiency in Pastures .. 453
Food Plan, Great Britain's Three-year 244
Forest Blue Grass 337
Forestry, Value of, in War Time Economy 234
Fowls, Feeding 406
Freezing Process, A new 422
French Beans 214
Fruit—
  Juices as Summer Drinks .. 252
  Market 111, 221, 331, 410, 493, 582
  Marketing 419
  Marketing Organisation Acts .. 116
  Trees, Planting 107
Fused Needle Disease and its Relation to the Nutrition of Pinus .. 45, 156, 278, 374, 434

G

Gardening for Grace 256
Gas in Silo, Beware of 243
Gas Units on the Farm, Producer 502
Germination of Wattle Seeds .. 241
Giant Setaria (Giant Panicum) 105
Giant Star Grass for Soil Erosion 249
Ginger, Production of 591
Give 'Em Beans 596
Glycine Pea 501
Goat, the Useful 123
Goondinwindi, a Fauna Sanctuary 591
''Gooseberry, Wild'' 500
Grass—
  A Nutritious 420
  Para, for Damp Places 105
  Rhodes, as a Hay Crop .. 209
  Urochloa 526
  and Water 242
Great Britain's Three-year Food Plan 244
Grooming the Milking Cow .. 244

PAGE.

H

Ham and Eggs as a ''Chain'' Lunch 123
Handling Citrus Fruits 492
Hatcheries, Registered 99, 201, 323, 402, 481, 569
Hay Crop, Rhodes Grass as a .. 209
Hay Crops for Cane Farms .. 562
Heavier Seeding for ''Poona'' Peas 488
Hemlock—''Carrot Fern'' or ''Parsley Fern'' 240
Herd Stud Book, Production Recording for Advanced Register of 114, 334, 496
Herd Testing and Recording .. 195
Hoary Cress—A Serious Pest .. 118
Honey Board 418
Horehound 240
Horse—
  Collar, Doing Without a .. 246
  How to Shoot a 234
  in England, Back to the .. 248
Horse Breeding—
  a National Duty 228
  Revival in—War Influences .. 339
Horses—
  A plant Harmful to 420
  Botflies in 476
  Earn their Salt 474
Horse's Nosebag, The 209
How to Plant a Deciduous Fruit Tree 489
How to Shoot a Horse 235
Hyacinth, Menace of Water .. 598

I

Importance of Molasses as Fertilizer 208
Improvements on the Small Sheep Property 192
In Memoriam—
  Lieutenant-Colonel A. H. Cory V.D., M.R.C.V.S. 239
  Helmsing, Iwan Wassil .. 413
  Henry Brice 414
Inferior Cream 197
Infra-red Rays and Seed Germination 339
Insect Parasites of Sheep .. 530
Irrigation Practice on Brie Brie Estate, Mossman 556
Isolation Pen for Sick Pigs .. 200

J

Johnson Grass 117, 499
Josephinia Burr 241
Judging a Dairy Heifer .. 339

PAGE.

K

Keeping Pigs Healthy 567
Knot Grass. Summer Grass .. 241

L

Labelling the Export Apple Case 110
Lamb Quadruplets 598
Lamb-marking 194
Lamb-marking, A and Blowfly Specific 394
Lamb-raising, Merino Ewes for .. 475
Lamb-raising, Right Type of Ewes for 317
Lambing Ewe, A "Spot" for the 249
Lambs, Fat, The Dorset Cross for 422
Lambs, Heavier, Wanted 422
Land Girls on the Job 593
Land Valuation 347
Lettuce Growing 217
Lettuce, the Growing of Summer 108
Levy on Bananas 116
Levy, Citrus 419
Live and Dressed Weight of Bacon Pigs 199
Low Production Cost 398
Lubricating the Separator .. 92
Lucerne, Establishing 206
Lucerne on the Downs and Maranoa 210
Lucerne Seed, Dodder in .. 326
"Lumpy Jaw" of Cattle .. 473
Luxury Crops Eliminated .. 407

M

Mackay District, Some Agricultural Problems of the .. 454
Maize—
  and Pork Quality 98
  Seed Selection 204
  Weeder, A Handy 244
Making Swamp Lands Profitable 119
Man and Animal—Sympathy, not Sentiment 484
Mange in Pigs 567
Manure, Animal 104
Manure and Fertilizer 213
Marginal Cream 479
Market, The Fruit 221, 331, 410
Marketing Cauliflowers 580
Marking Cases 218
Marking Early Laying Pullets 101, 404
Maternal and Child Welfare 127, 342, 425, 507, 602
Meals, Blood and Meat 565
Meat for the Troops—How the Army Ration Originated .. 502
Meat and Blood Meals 565

PAGE.

Meat Meal for Cows 339
Meat Meal for Pigs 568
Meat Meal, Protein and 93
Medick Burr 241
Menace of Water Hyacinth .. 598
Menu, Tomatoes on the 129
Merino Ewes for Fat Lamb Raising 475
Message, The Minister's 3
Milk—
  and Cream, A Common Winter Defect in 397
  Board, Brisbane 228, 419
  Drinks, Cooling 259
  Effect of Cow's Age on .. 479
  in the Home 604
  Problems of Keeping, in the Home 553
  Process, A new 339
  Straining 564
  Supply Regulations 115
  Tests, Variation in 178
  Wholesome 566
Milking—
  Cow, Grooming the 244
  Dry Milking is Clean 398
  Machines, Care of 477
Minister's Message 3
Molasses for Potash Deficient Soils 464
Mud, Money in 244

N

Nation, The, Must be Fed 514
Native Panic Grass, A 499
"Never Fail"—A Common Grass 118
New Plough to Shorten Farmer's Day 119
New Processes in Wool Economy 122
New Queensland-bred Seedling Canes 486
Nosebag, The Horse's 209
Nutritious Grass 420
Nuts, the Quality of Queensland 409

O

Onion-growing 328
Open Season for Duck and Quail 590
Oranges and Lemons—Citrus Fruit in Dessert Courses 606
Orchard Notes .. 126, 251, 341, 424, 506, 600
Orchard, Winter Activities in the 582
Over-run, What is a Fair? .. 319

P

Para Grass for Damp Places .. 105
Parasites of the Horse 350

PAGE.

Parasitic Worm Diseases of Cattle 136
Parsley 330
"Parsley Fern" or "Carrot Fern"—Hemlock 240
Passion Fruit Growing in Queensland 55
Pastoral By-products, the Value of 422
Pasture Management 318
Pasture, Pride in 248
Pastures, Food Deficiency in .. 453
Pastures, Winter 406
Patriotism, Practical 249
Peanut Industry 116, 590
Pear and Apple Varieties .. 215
Pedigree Stock Farm, Britain the World's 422
Pest Destroyers Act, Regulations under the 419
Pest Destruction 419
Pig-breeding Records 481
Pig-feeding 401, 480
Pig-feeding, Profitable 535
Pigs—
  being Divorced from Cows .. 242
  Charcoal for 98
  Isolation Pen for Sick 200
  Keeping Healthy 567
  Live and Dressed Weight of Bacon 199
  Oiling 401
  Points of a Good Boar 97
  Preparing, for Show 96
  Salt for 400
Pineapple Culture in Queensland 6, 266
"Pink-Eye" in Sheep 316
Pinus, Fused Needle Disease and its Relation to the Nutrition of 45, 156, 278, 374
Plant Harmful to Horses 420
Planting Fruit Trees 107
Plants from Oakey District Named 501
Playgrounds under the Plough 597
Plough, The 208
Ploughing, One Way of Getting it Done 340
Ploughing for Victory 121
Ploughing up Britain 246
Points of a Good Boar 97
Poisonous to Stock—
  Two Plants 547
  Wild Poppy a Plant 420
  Yellowwood 86
Polled Merinos—Queensland Breeders' Success 596
Pork Quality, Maize and 98
'Possums, No Open Season for .. 590

PAGE.

Potato—
  Crop, Protect the, against Irish Blight 574
  Grade 585
  Standards 116
  The Sweet 573
Potatoes in Central Queensland 103
Poultry—
  Effect of Climatic Conditions on Different Classes of 325
  The Purchase of 101
  Worms in 203
Preparing Land for Wheat .. 211
Preparing Pigs for Show .. 96
Preservation of Wild Life .. 116
Prevent Bush Fires—Carelessness Costs Lives and Money 315
Primary Products for Secondary Industry 102
Problems of Keeping Milk in the Home 553
Producer Gas Units on the Farm 502
Production Recording 114, 334, 416, 496, 586
Profitable Dairying 94
Profitable Pig Feeding 535
Protect the Potato Crop against Irish Blight 574
Protein and Meat Meal 93
Psycho-Analysis for Cows .. 119
Pullets, Marking Early Laying 101, 404

Q

Queensland Show Dates for 1940 85, 220, 341, 392, 460, 529
Queensland's Progress 433
Queensland's Rural Wealth .. 433

R

Rainfall in Agricultural Districts 131, 261, 345, 429, 511, 607
Rats, Rough on 339
Recording, Production 114, 334, 496
Recording and Herd Testing .. 195
Red Head or Milky Cotton Bush 117
Redwater in Cattle 318
Registered Hatcheries 99, 201, 323, 402, 482, 569
Registered Stallions 223
Regulations under the Pest Destroyers Act 419
Rejected Stallions 227
Replacement of Citrus Trees in Established Orchards 109
Resting Stock before Slaughter 474
Reworking Drone Citrus Trees .. 218
Rhodes Grass as a Hay Crop .. 209
Right Type of Ewes for Lamb-raising 317
Rust Control, Banana 109
Rust Thrips Control, Banana, Substitute Bunch Covers in 216

PAGE.

S

Sales Tax on Farm Equipment .. 338
Salt for Pigs 400
Scrub Feeding, Easy 505
Scrub Feeding of Sheep 89
Secondary Industry, Primary Products for 102
Seed Containers, Use of Salt Bags as 106
Seed Germination, Energy of Growth in 213
Seed Germination, Infra-red Rays and 339
Seed Maize Selection 204
Selecting New Banana Areas .. 580
Separator Float, The 93
Separator, Flushing the 399
Separator, Lubricating the .. 92
Shearing Achievement, Another .. 503
Sheep, Blowfly Dressing, New .. 504
Sheep, Counting 476
Sheep, Dipping 193
Sheep, Drenching 190, 393
Sheep, Drought Feeding of .. 593
Sheep, Feeding Scrub to 89
Sheep, "Pink-Eye" in 316
Sheep, the Insect Parasites of .. 530
Sheep Property, Improvements on the Small 192
Short, Richard P. M., Appointment of, as Under-Secretary .. 5
Show Dates, Queensland, for 1940 85, 220, 341, 392, 460, 529
Show Ring, Sportsmanship in the 495
Sick Animals, Care of 291
Silk Cotton Tree 499
Silo, the Trench 205
Size of Apples 237
Soil, That Top Layer of 248
Soil Erosion, Giant Star Grass for 249
Soils Deficient in Potash, Molasses for 464
Some Agricultural Problems of the Mackay District 454
Some Tropical Fruits—The Woolmi 577
Sorghum, A Native 499
Sorghum Poisoning Antidote .. 91
Sorghums for Fodder and Grain .. 120
Sow, The Farrowing 322
Spiny Burr Grass 499
Sportsmanship in the Show Ring 495
Staff Changes and Appointments 115, 236, 336, 418, 498, 588
Stallion, District Central Coast .. 498
Stallions Registered 223
Stallions Rejected 227
Star Thistle—A Serious Pest .. 240
Stock, Resting, before Slaughter 474

PAGE.

Stock, Yellowwood Poisonous to .. 86
Straight Fertilizers and Their Incorporation into Fertilizing Mixtures 187
Strangles 88, 472
Substitute Bunch Covers in Banana Rust Thrips Control 216
Sugar Cane, Cold Resistant .. 559
Sugar-cane—A Warning against Planting "Misses" with a Second Variety 106
Summer Drinks, Fruit Juices as .. 252
Summer Grass—Knot Grass .. 241
Summer Salads in the Farm Kitchen 258
Swamp Couch 332
Sweet Melilot 501

T

Tail, A Swish of a—and a Tale of a Swish 235
That Toy Layer of Soil 248
The British Breakfast 595
The Chicken Season 571
The Electric Fence, The Effectiveness of 248
The Empire and Trade 349
The Farm Kitchen—
  Citrus Fruit Jams 547
  Summer Salads 548
The Farmer and the War 245
The Farmer in War-time Britain 243
The Farmers' Feathered Friends 593
The Farmers of the Future .. 488
The Farrowing Sow 322
The Fruit Market .. 111, 221, 331, 410, 493, 582
The Growing of Summer Lettuce 108
The Horse's Nosebag 209
The Insect Parasites of Sheep .. 530
The Nation Must be Fed 514
The Parasitic Worm Diseases of Cattle 136
The Purchase of Poultry 101
The Quality of Queensland Nuts .. 409
The Realities of War 431
The Separator Float 93
The Spraying of Early Beans .. 329
The Sweet Potato 573
The Trench Silo 205
The Useful Goat 123
The Value of Sleep and Rest in Childhood 252
The Veterinary Medicines Acts, 1933 to 1938 469
The Walnut 582
The Woolmi—Some Tropical Fruits 577
"Tick Washing" and Tick Fever 395
Timber, Green, When to Poison .. 328

PAGE.

To Prevent Bruising in Trucking Yards 395
Tobacco Leaf Board, Proposed .. 591
Tobacco Seed-bed Fertilizer Experiment 516
Tomato Growers, A Seasonal Reminder to Central Queensland 219
Tomatoes in Frost-free Areas .. 579
Tomatoes on the Menu 129
Tractor "Speedo," Something like a 248
Trade and the Empire 349
Treatment of Cream 244
Trees and Shrubs Suitable for the South Burnett. An Excellent Tree Supply Service to Farmers 592
Trees for a Windbreak 332
Trees for Open Downs Country .. 420
Trees, Windbreaks and Shelter .. 407
Tridax Weed 592
Trough, Feed, on Skids 44
Turkey Berry 118
Two Plants Poisonous to Stock .. 547

U

Urochloa Grass 526
Use of Salt Bags as Seed Containers 106

V

Value of Forestry in War Time Economy 234
Value of Pastoral By-products .. 422
Valuation of Land 347
Variations in Milk Tests 178
Vegetable Crops, Fertilizing for Better 421
Veterinary Medicines Acts, 1933 *to* 1938 469

W

"Waler", A Word for the .. 247
War and the British Farmer .. 247
War and the Farmer 245
War Time Agriculture 124
War Time Agriculture in Britain 595

PAGE.

War Time Beef Needs 598
War Time Britain, The Farmer in 243
War Time Economy, Value of Forestry in 234
War Effort by the British Farmer 594
War—When it is Over 349
Wattle Seeds, Germination of .. 241
Wealth in the Rubbish Bin .. 595
Weaners, Care of 400
Weather Wisdom 246
Weed Killing, Three Golden Rules 246
What is a Fair Over-run? 319
Wheat, Preparing Land for .. 211
Wheat Yield, A Wonderful .. 247
When Appetities are Tight .. 421
When the War is Over 349
When to Poison Green Timber .. 328
Where are the "Walers"? .. 122
Whey, Another New Way with .. 120
Whey, Another Way to Use .. 421
White Passion Vine 500
White-striped Cows in a Blackout 245
Wholesome Milk 566
Why the Price Goes Up 421
Wild Life Preservation .. 116, 419
Wild Life Preservation — Toowoomba 237
"Wild Lucerne" 501
Wild Poppy, A Plant Poisonous to Stock 420
Windbreaks and Shelter Trees .. 407
Winter Comes, Before 321
Winter and Spring Feed 327
Winter Pastures 406
Wistaria 420
Wool Economy, New Processes in 122
Worms in Poultry 203

Y

Yellow Oleander 240
Yellow Pea 241
Yellowwood—Poisonous to Stock 86
Young Farmer—Interstate Competition 587
Young Farmers' Clubs—National Recognition 515

INDEX TO ILLUSTRATIONS

PAGE.

Applied Phosphate Directly Absorbed 446

Benyenda Nursery, Gayndah—

- In This Nursery There are 60,000 Citrus Trees 412
- Rotary Hoe at Work in the Citrus Grove 424

Bligh's, A. C. V., Station Home, Condamine Plains, Darling Downs 257

"Bostocks," On the Lawn at, Mr. R. Bligh's Home, near Brookstead, Darling Downs .. 257

Cane Hoisting—

- Close-up View of Motor Cycle Engine Adapted for Use in Cane Hoisting 461
- Cane Load which had just been lifted by the Small Engine .. 463
- Plan and Side View of the Arrangement Used 462

Cold Resistant Sugar Cane—Aerial View of Meringa Sugar Experiment Station 561

Feed Trough on Skids 44

Fused Needle Disease and its Relation to the Nutrition of Pinus—

- The Effect of Carbohydrate Injections of Fused Needle-Affected *Pinus caribœa* .. 439
- The Effect of Carbohydrate Injections on Fused Needle-Affected *Pinus tœda* 437
- Fascicles of *Pinus caribœa* .. 160
- Fertilizer Experiments, Block NB (*Pinus tœda*) 300
- Fused Fascicle of *Pinus caribœa* 50
- Fused Needle Disease in Eight-years-old Plantation Tree of *Pinus tœda* 157
- Fused Needle Symptoms in *Pinus caribœa* 48
- Fused Needle—*Pinus tœda*, Block K, Bluegum L.A. 284
- Litter and Fertilizer Experiments, Block K (*Pinus tœda*) 285, 287, 288-289
- Longitudinal Section Through an Endotrophic Mycorhiza of Hoop Pine 376
- Longitudinal Section Through an Endotrophic Mycorhiza of Hoop Pine 378
- Longitudinal Section Through a Fused Needle Type of Mycorhiza of *Pinus tœda* .. 387
- Longitudinal Section Through a Normal Ectotrophic Mycorhiza of *Pinus tœda* 387
- Longitudinal Section Through a Normal Ectotrophic Coralloid Mycorhiza of *Pinus tœda* 376
- Needle Fusion Symptoms in *Pinus tœda* 158
- Root Grafting Experiment. View showing pegs marking root grafts on to Central tree (fused) of *Pinus tœda* .. 165
- Root graft *in situ* on *Pinus tœda* (fused to healthy tree) .. 165
- Section through an Abnormal Mycorhizal Root Typical for a Fused Needle Affectd Tree (*Pinus tœda*) 389
- Soil Manuring Experiment—
  - Block N.A. (*Pinus tœda*) .. 298
  - Block N.B. (*Pinus tœda*) .. 303
  - Block N.C. (*Pinus tœda*) .. 306
  - Block N.D. (*Pinus caribœa*) .. 308
- Soil Organic Matter Experiment—
  - Block K. (*Pinus tœda*) .. 284
  - Blocks L. and M. (*Pinus caribœa* and *Pinus tœda*) 291, 294, 295
- Sporophore of *Rhizopogon roseolus* in Association with the Roots of *Pinus tœda* in Pure Culture 380
- "Thin Crown" Type of Fused Needle Disease in Plantation at Beerwah 52
- Tree with peg showing effect of grafting fused leader of *P. caribœa* on to healthy *P. tœda* stock 164
- Twig of *Pinus caribœa* 49
- Typical aspect of area subject to needle fusion 161

Giant Crotalaria, Illustrating the Growth of the 458

Gregory River, Gulf Country, North Queensland, A Jungle Shadowed Reach of the 601

Heterodendron oleœfolium Narrow-leaved Form—

- From Blackall Mixed Sample .. 549
- From Dalby Sample 550

How to Shoot a Horse 235

In Memoriam—

- Cory, A. H., Lieut.-Colonel A. H., V.D., M.R.C.V.S. 238
- Helmsing, Iwan Wassil .. 413
- Henry, Brice 414

Irrigation Practice on Brie Brie Estate, Mossman—

- Illustrating the Arrangement of Tractor, Pump, and Fluming 557

PAGE.

Showing the Manner in which the Pump is Attached to the Tractor Frame 558
Leichhardt River at Kajabba, North-Western Queensland .. 260
Pals—In many parts of Western Queensland, particularly in mining centres, the goat is a domestic necessity as the supplier of rich, wholesome milk 428
Parasites of the Horse—
- Adult Botflies 364-365
- Device for Protection Against the throat and nose Botflies 368
- External Parasites 369, 370, 372
- How Horses Become Infected with Worms 351
- Large Stomach Worms (*Habronema* spp.) 357
- Leather Nose-Fringe as Protection against the Nose Botfly 367
- Pinworms (*Oxyuris equi*) .. 363
- Red Worms (*Strongylus* and *Trichonemidæ*) .. 360-361
- The Lappetted Tapeworm of the Horse (*Anoplocephala perfoliata*) 355
- The Large Tapeworm of the Horse (*Anoplocephala magna*) 355
- The Large Roundworm (*Ascaris equorum*) 359

The Parasitic Worm Diseases of Cattle—
- Beef Nodule 155
- Calf Heavily Infected with Worms 138
- Conical Fluke 142
- Hookworm 149
- How Cattle Become Infected with Worms 137
- Large Bowel Worm 154
- Large Stomach Worm or Barber's Pole Worm 145
- Lesser Stomach Worm 147
- Lungworm 153
- Small Intestinal Worm 150
- Stomach Hair Worm 148
- Tapeworm 143
- The Liver Fluke 140
- Whipworm 152

Passion Fruit Growing in Queensland—
- A Good Crop of Skinless Barley in a young Plantation, ploughed under in February 79
- A Horizontal Trellis With Three and Four Wires 75
- A One-time Banana Plantation Trellised for Passion Fruit Vines 57

PAGE.

- A Six-months-old Vine Showing First Fruit 59
- A Six-wire Vertical Type Trellis 76
- A Trellis Made with Welded Sheep Fencing Wire 76
- A Young Passion Fruit Vineyard on Red-oak Soil at Mudgeeraba 56
- After the Vines have covered the Trellis, Cover Cropping should be confined to Narrow Strips down the Middle of the Rows 79
- An Established Passion Fruit Vineyard at Springbrook .. 56
- Deep Cultivation should only be carried out towards the End of Winter 77
- Diagram showing how the extension Trellis is attached to the Main Trellis 67
- Horizontal or "T" Type of Trellis with Two Wires .. 65
- Laterals when trained to grow straight downward assist in keeping the Vine open, and the Work of Spraying, Harvesting, and Pruning is simplified .. 73
- Light Stakes should be used as Supports for the Vines until they have become firmly established on the Wires 71
- Preparing Hillside Land by Hand for Passion Fruit .. 61
- Rain Forest or "Scrub" Land Cleared for Planting .. 63
- Reconditioning Passion Vine Soils 78
- Rising Ground on One Side and a Solid Belt of Timber provides Good Protection from Winds 59
- Showing the Development of Four Stems 72
- Trellises must be Well Stayed .. 66
- Vertical or Fence Type of Trellis with Three Wires 65
- Vine after Pruning 82
- Vine Ten Months Old showing Sturdy Growth of Twin Leaders, Dense, Vigorous Laterals, and Advanced Fruit 59
- Vines Planted up and down the Slope 63

Pineapple Culture in Queensland—
- A Clone of Six Plants of a Desirable Type of Smooth Cayenne, all of which were propagated from a Single Parent 35
- "Cannon Ball" type of Fruit 32
- Clonal Selection in the Smooth Cayenne Variety: in each row, all Plants between Stakes are Descendants of a Single Parent 40

PAGE.
"Collar of Slips"—Sectional View showing Slips originating from the Base of the Fruit .. 22
"Crippled" Fruits of the Queen Variety 33
Demonstration of the Inheritability of the Dry Fruit and Bottle-neck Mutation 31
Demonstration on Transmission of Vigour 18
Dry Fruit on the Left: Bottle-neck Fruit on the Right .. 30
Five Plants Propagated from a Single "Collar-of-Slips" Plant, All Exhibiting the Character of the Parent .. 24
Fruit of the Queen Variety and Ripley Queen Variety 10
Hybrid Pineapple Seedlings being "hardened off" in a Lath House at the Experiment Station 16
Knobby Outgrowths Protruding from the Base of a Fruit which was produced on a Plant possessing "the Collar-of-Slips" Tendency 21
"Near Collar-of-Slips": Sectional view showing Slips arising close to but not directly from the base of the Fruit .. 23
Plant of the MacGregor Variety: Showing the characteristic sturdy compact habit of growth free suckering tendency, and blocky type of Fruit 11
"Prickly-eyed" or "Christmas" Type of Smooth Cayenne Fruits 34
Slips Desirably Placed on the Fruit Stalk 38
Summer Type of Smooth Cayenne (South-Eastern Queensland) 37
The "Long Tom" Mutation—note the abnormally large flat eyes, some of which protrude at the top of the fruit to form "knobs" 28
The Small Diameter Mutation—note the knobs at the base of the fruit 27
PAGE.
The Smooth Cayenne Pineapple 8
The Stump Section Method of Propagation 42
Typical "Collar-of-Slips" Plant with Leaves cut away to show Total Absence of Suckering 20
Two-year-old Plantation of the Queen Variety on Magnetic Island, North Queensland .. 12
Winter Type of Smooth Cayenne (South-Eastern Queensland) 36
Year-old Plants Propagated by the Stump Section Method .. 43

SHORT, R. P. M.—

Under Secretary, Department of Agriculture and Stock .. 4
Some Tropical Fruits—The Woolmi (Stephens) 578

The Insect Parasites of Sheep—

Foot Louse (*Linognathus pedalis*) x 48 542
Red-Headed Louse (*Bovicola ovis*) x 48 541
Sheep Blowflies 531
Sheep Ked (*Melophagus ovinus*) x 14 544
Sheep Nasal Fly (*Oestrus ovis*) 545

Tobacco Seed-Bed Fertilizer Experiments—

Graph Showing Average Seedling Growth, Response to .. 520
Second Seed-Bed Fertilizer Experiment—Two plots illustrating the striking increase in growth produced by superphosphate 519
Superphosphate at Various Levels of Sulphate of Potash .. 522

Two Plants Poisonous to Stock—

Boonaree or Western Rosewood (*Heterodendron oleæfolium*) 548
Heterodendron oleæfolium (normal) Broad-leaved from Blackall 548
Ximenia Americana from Clermont 551
Under Secretary, Department of Agriculture and Stock, Mr. R. P. M. Short 4
Urochloa Grass—A Grass of Potential Economic Importance 527

AUTHOR INDEX

PAGE.

BARNES, H., and J. M. WILLS—
  Passion Fruit Growing in Queensland .. ..

COLEMAN, F. B.—
  Straight Fertilizers and Their Incorporation into Fertilizing Mixtures 186
  "*The Veterinary Medicines Acts, 1933 to 1938*" 469

CRAWFORD, W. H., and G. BATES—
  Irrigation Practice on Brie Brie Estate, Mossman 556

FRANCIS, W. D., Botanist—
  Answers to Correspondents—Botany 117

GREGORY, JAS. H.—
  The Fruit Market .. 111, 221, 331, 410, 493, 583

GURNEY, E. H., and W. D. FRANCIS—
  Two Plants Poisonous to Stock 547

KERR, H. W.—
  Some Agricultural Problems of the Mackay District 454

KING, W. J.—
  Hay Crops for Cane Farms .. 562

KUDELKA, O.—
  Problems of Keeping Milk in the Home 553

LEWCOCK, H. K.—
  Pineapple Culture in Queensland 6, 266

MANDELSON, L. F.—
  Tobacco Seed-bed Fertilizer Experiments 516

PAGE.

McDOUGALL, W. A.—
  Control of Rats in Queensland Cane Fields 465

RICE, E. B.—
  Variations in Milk Tests .. 178

RICHARDS, A. S.—
  Rainfall in the Agricultural Districts 131, 261, 345, 429, 511, 607

ROBERTS, F. H. S.—
  The Insect Parasites of Sheep 530
  The Parasitic Worm Diseases of Cattle 136
  Parasites of the Horse 350

SMITH, L. S.—
  Urochloa Grass 526

STEPHENS, S. E.—
  Some Tropical Fruits — The Woolmi 577

TAYLOR, R. A.—
  The Acid or Base Forming Property of Fertilizers Sold in Queensland 230

WHITE, C. T.—
  Answers to Correspondents—Botany 240, 337, 420, 499, 592

YOUNG, H. E.—
  Fused Needle Disease and its Relation to the Nutrition of Pinus 45, 156, 278, 374, 434

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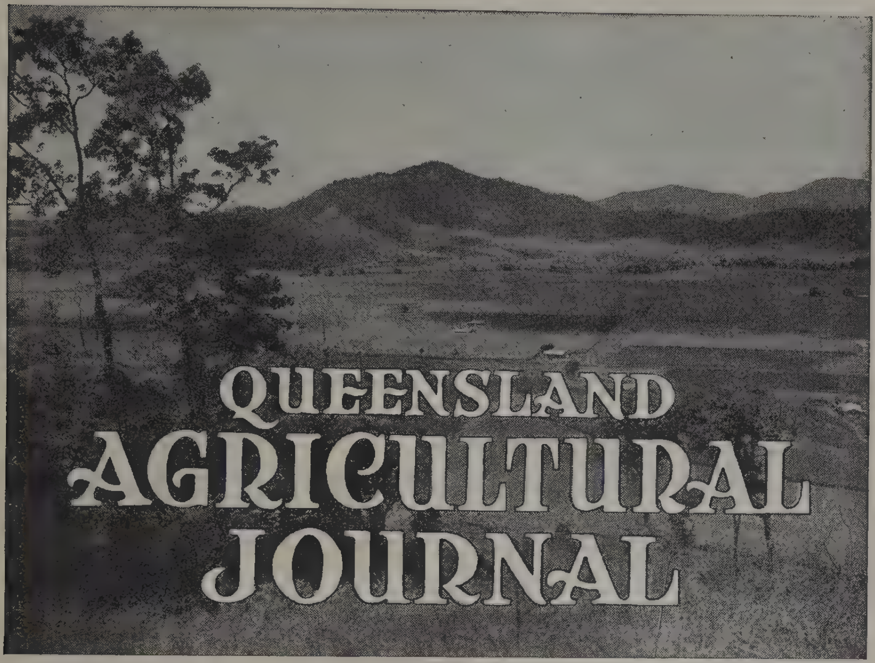

QUEENSLAND AGRICULTURAL JOURNAL

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Event and Comment

The King Speaks to His People.

"I BELIEVE in my heart that the cause which binds together my peoples, and our gallant and faithful Allies, is the cause of Christian civilisation. True civilisation can be built on no other basis," said His Majesty King George VI. in his Christmas broadcast to the Empire.

"Let us remember this through the dark times ahead of us, and when we are making peace, for which all men pray. The New Year is at hand. We cannot tell what it will bring," said his Majesty.

"The festival which we know as Christmas is above all a festival of peace and of the home. Love of peace is profound among all free peoples, because this alone gives security to the home. True peace is in the hearts of men. It is a tragedy that this Christmas there are powerful countries whose whole direction and policy are based on aggression and suppression of all we hold dear for mankind.

"It is this that has stirred our peoples and given them unity unknown in any previous war.

"We feel in our hearts that we are fighting against wickedness. This conviction has given us strength from day to day to persevere until victory is assured.

"At home we, as it were, are taking the strain for what may lie ahead, resolved and confident. We look with pride and thankfulness on the never-failing courage and devotion of the Royal Navy, upon which throughout the last four months has burst a storm of ruthless, unceasing war.

"When I speak of our navy, I mean all the men of our Empire who go down to the sea in ships—the mercantile marine, mine sweepers, trawlers, and drifters.

"From the senior officers to the last boy who has joined up I send a message of gratitude and greeting to everyone of this great fleet, from myself and from all my peoples.

"The same message I send to the gallant Air Force, which, in co-operation with the navy, is our sure shield of defence. Daily they are adding to their laurels and to those their fathers won.

"I would send a special word of greeting to the armies of the Empire, to those who come from afar, and in particular to the British Expeditionary Force. Their task is hard. They are waiting. Waiting is a trial of nerve and discipline, but I know that when the moment comes for action, they will prove themselves worthy of the highest traditions of their great service.

Empire One Purpose.

"To all who are preparing themselves to serve their country on sea or land or in the air, I send greetings. At this time the men and women of our far flung Empire are working at their several vocations with one and the same purpose, all are members of a great family of nations which is prepared to sacrifice everything that the spirit of freedom may be saved to the world.

"Such is the spirit of the Empire, the great Dominions, India, and every colony, large or small. Offers of help have come from all alike. For this the Mother Country can never sufficiently be grateful. Such unity of aim in effort has never been seen in the world before.

"If the New Year brings peace, how thankful we shall be. If it brings continued struggle, we shall remain undaunted.

"Meanwhile, I feel that we all shall find a message of encouragement in the lines which, in my closing words, I should like to read to you:—

> " 'I said to the man who stood at the gate of the year, 'Give me a light that I may tread safely into the unknown,' and he replied, 'Go out into the darkness and put your hand into the hand of God. That shall be to you better than light, and safer than a known way.'

"May that Almighty Hand guide and uphold us all!"

The Minister's Message.

SINCE last I had the privilege of addressing a New Year message to the farmers and graziers of the State, I have been on an overseas mission in quest of information of practical use to our agricultural and stock-raising industries. In pursuit of this knowledge, I visited many countries with rural problems resembling our own. An opinion brought back is that our practices can be, in the main, compared with the methods in vogue in other lands and that our agricultural prestige does not suffer by such comparison. On the technical side, the work of our agricultural officers compares favourably with the work being performed overseas. In addition, for a variety of reasons, our agriculture is better circumstanced than is the position in some countries which I visited.

However, each country has some contribution to make to the well-being of world agriculture and many countries are capable of challenging us for agricultural markets. It is clear, therefore, that our policy must be in the direction of ever greater efficiency, more especially in our economic organisation. I am convinced that agricultural organisation will increase in importance as time goes on and the countries with the best organisation of its agricultural resources will eventually win in the world markets.

So far, the producers of Queensland have not lagged behind in this economic contest, but other countries are now putting on the pace. Nevertheless, with loyalty to the ideals of orderly marketing, I am sure we can continue to hold our own.

Probably the New Year will bring a degree of much-needed stability to our primary industries, but the need of the United Kingdom at the present will confer no rights in respect to the markets of the future. Our title to these markets will be the merit with which we perform our tasks of production during the war period.

On behalf of my officers and myself, I wish all our primary producers a happy and prosperous 1940.

Frank. W. Bulcock

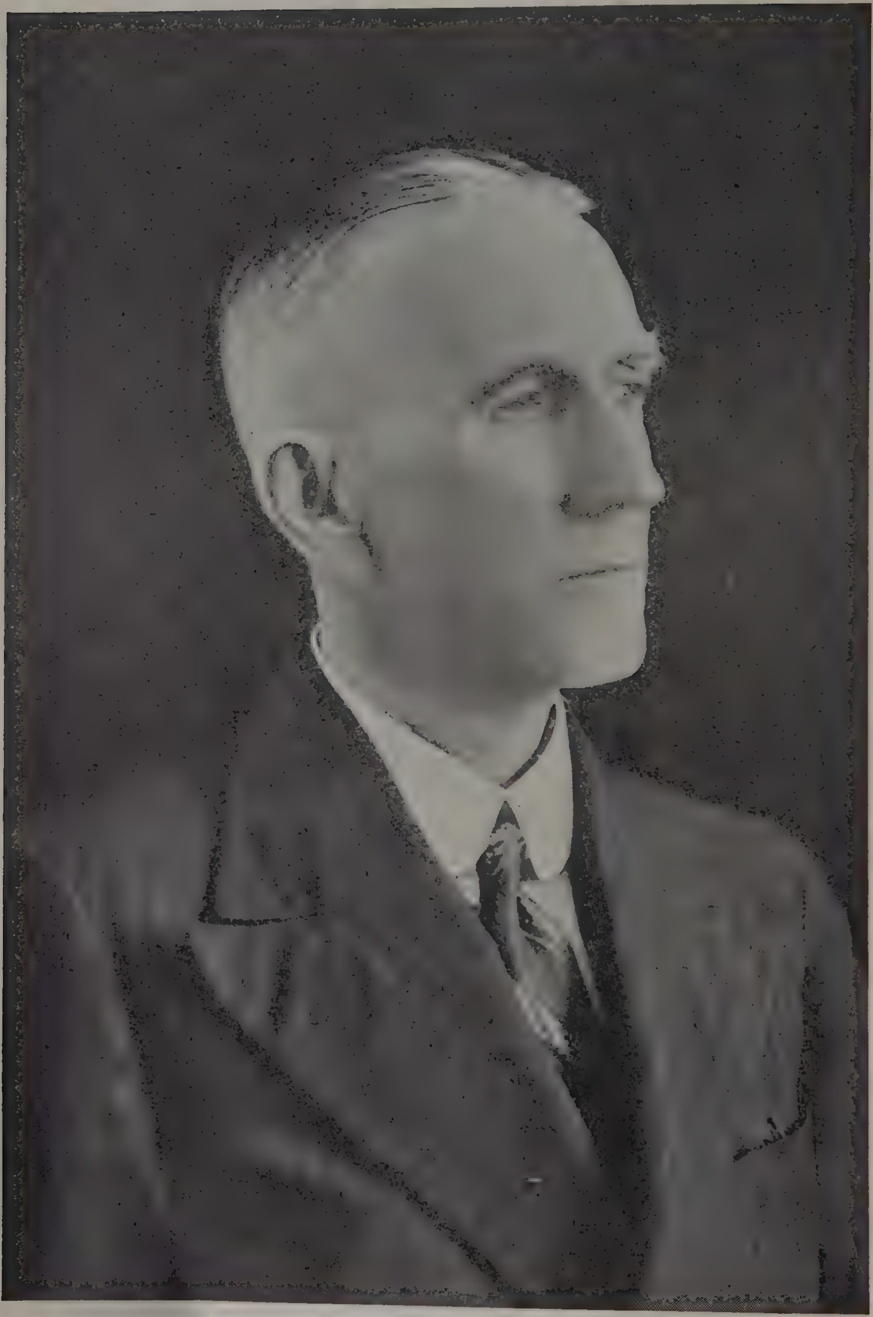

Plate 1.

MR. R. P. M. SHORT, Under Secretary, Department of Agriculture and Stock.

NEW DEPARTMENT CHIEF.

Appointment of Mr. Richard P. M. Short.

MR. Richard P. M. Short, who had been Acting Under Secretary of the Department of Agriculture and Stock since 16th February of last year, has been confirmed in the position of administrative head of the Department after more than 40 years' continuous service.

Mr. Short is the second of three generations who have occupied important positions in the State Public Service, his father having been Commissioner of Police, and a son, at present with the Second Australian Imperial Force enlisted for active service, is an officer of the State Insurance Department.

Mr. Short, who possesses a wide knowledge of men and affairs, has had special opportunity of gaining administrative experience in both major sections of the Department of which he is now the chief, having been an officer of the Stock Branch from 1898 until 1924, when he held the positions of senior clerk and registrar of brands. He also was secretary of the Cattle Tick Committee, which consisted of representatives of the Council for Scientific and Industrial Research and of the Queensland and New South Wales Governments.

While in the Stock Branch he edited "The Drovers' Guide," which was distributed amongst stock owners in this and other States of the Commonwealth.

Mr. Short was appointed senior clerk in the Department in 1925, and continued in that position until his appointment as chief clerk on 1st July, 1933.

Mr. Short also holds the following additional positions in the Department:—

Chairman of the Rural Development Board.

Member of the Standing Committee of the Australian Agricultural Council.

Member of the State Committee of the Council for Scientific and Industrial Research.

He is also trustee for parks and gardens under the jurisdiction of the Department and of certain properties resumed by the Department for experimental purposes.

In his earlier days he was connected with many sporting activities, especially cricket and tennis. He was a member and secretary of the Toombul Electorate Cricket Club in the heyday of that club's success. In latter years he has confined his sporting activities to the bowling green, as a member of the Booroodabin Bowling Club, on one occasion being a member of the champion rink of that club.

Pineapple Culture in Queensland.

H. K. LEWCOCK, M.Sc., B.Sc. Agr., Senior Research Officer.

(*Continued from page* 632, *December*, 1939.)

Chapter III.—VARIETIES OF THE PINEAPPLE.

Much confusion exists regarding the nomenclature of pineapple varieties, because nearly all of the leading varieties are known by different names in different countries. In England, the Smooth Cayenne, which is the favourite variety for hothouse culture, is known as the Kew pineapple, while in Malaya it is called the Sarawak; on the other hand, the Queen is referred to in South Africa as the Natal and in Queensland as the Rough-leaved or Common Rough variety. Some fifty or sixty so-called "varieties" have been listed and described at different times, but the number of commercially important varieties now in cultivation probably does not exceed six or seven.

Hume and Miller have classified the cultivated varieties of the pineapple into three horticultural groups, the representatives of each group resembling each other in general characteristics, viz., the Queen, the Cayenne and the Spanish groups. Included in the first-named group are the Queen and the Ripley Queen. The Smooth Cayenne is the only important representative of the second group, while the Red Spanish (sometimes known as Black Spanish or merely Spanish) is the type variety of the third group.

THE SMOOTH CAYENNE VARIETY.

The Smooth Cayenne variety is easily the most important of those grown at the present time, as it accounts for more than 80 per cent. of the total world production. Because of its size and shape and the texture and colour of its flesh the Smooth Cayenne is the preferred canning variety. Prior to the introduction of several new hybrids, it was the only variety grown for this purpose in Hawaii and it still constitutes the great bulk of the canned output from these islands. It is also the sole variety used for canning in Formosa, Queensland and the Philippines. In addition, most of the fresh pineapples shipped to European markets from the Azores and South Africa are of the Smooth Cayenne variety. Uncertainty exists regarding its origin, but its name suggests that it came from French Guiana. It was introduced into England from France about 1841 and most of the commercial plantings of this variety which are in existence to-day have stemmed from English stock, although Smooth Cayenne planting material is known to have been imported into the Azores from France in 1863. Presumably because it was at one time grown in hothouses at Kew Gardens, the Smooth Cayenne variety early became known in England as the Kew pineapple.

When and where Queensland obtained its first Smooth Cayenne plants is not recorded, but in all probability they were imported direct from England. It is unlikely that the first pineapples grown in this State were of the Smooth Cayenne variety, however, since records show that the original introduction of pineapple planting material into Queensland took place three years before the Smooth Cayenne was introduced into England. Nevertheless, it is known that the Smooth Cayenne was well established in Queensland by the middle of last century because, in 1903, the existence was reported of plantations of this variety which had then been in production continuously for more than fifty years. At the present time, more than 90 per cent. of the pineapples produced in Queensland are of the Smooth Cayenne variety. In addition to it being the one used exclusively for canning, it is also the only one which is in demand on the fresh fruit markets of the Southern States.

Like all pineapple varieties, the Smooth Cayenne is not particularly stable, since it has a strong tendency to produce bud sports. Many of these differ from the parent only in minor characteristics and, consequently, are not readily apparent. Unless rigorous selection is carried out, however, there is a tendency for some of the more frequently occurring bud sports to be propagated at a faster rate than the original parent type, with the result that distinctive strains are developed. This is particularly true of sports which produce a relatively large number of slips. Over a long period, therefore, the type of Smooth Cayenne which predominates in one country or one locality, may exhibit characteristics which distinguish it from what is regarded as the same variety in other regions or localities. One strain may be characterised by a dwarf, stocky habit of growth, while another may be tall-stemmed and long-leaved. Differences between strains also occur with respect to sucker and slip production, and particularly with respect to the shape and size of fruit. Consequently, there is a considerable divergence of opinion as to what constitutes a typical Smooth Cayenne plant, although the characteristics of a desirable type are relatively easy to define. Such a plant should be stocky and robust, with wide, tapering leaves. The stem should not exceed 12 inches in length and the fruit stalk not more than 6 inches. On fruiting plants, the leaves should average about seventy in number, and the longest should measure between 3 and 3½ feet in length and about 2½ inches in width at their widest part. The upper surface of these leaves should be a dark-olive green in colour with an irregular purplish-red streak extending the length of the leaf but confined largely to the central portion. Ordinarily, though not always, a few spines may occur near the tips or the bases of the leaves, but otherwise the leaf margins should be spineless.

The number of flowers in a single flower spike may vary within wide extremes, depending on environmental conditions, but normally it should lie between 130 and 170. The flowers are a light purple or violet in colour, while the bracts in which they are borne are bright red. The weight of the mature fruit varies somewhat in accordance with the number of flowers making up the flower head, but should average about 6 lb. on well-grown plants. Weights of 14 lb. and over have been recorded for individual fruits. The shape of the fruit may show considerable variation in different strains of the Smooth Cayenne variety. A shape approximating to the cylindrical is preferred for canning. (Plate 2.) Owing to the tendency of large-sized fruit to taper towards the apex, however, shape is to some extent determined by the growth conditions obtaining during the period of fruit development. In south-eastern Queensland the tendency to a conical shape is most pronounced in winter crop fruits and these, for reasons which have previously been outlined, average larger in size than those which mature during the warmer months. However, the pronounced conical shape which is characteristic of some types of Smooth Cayenne, even during the summer, is definitely undesirable, as is also a squat barrel shape, and both of

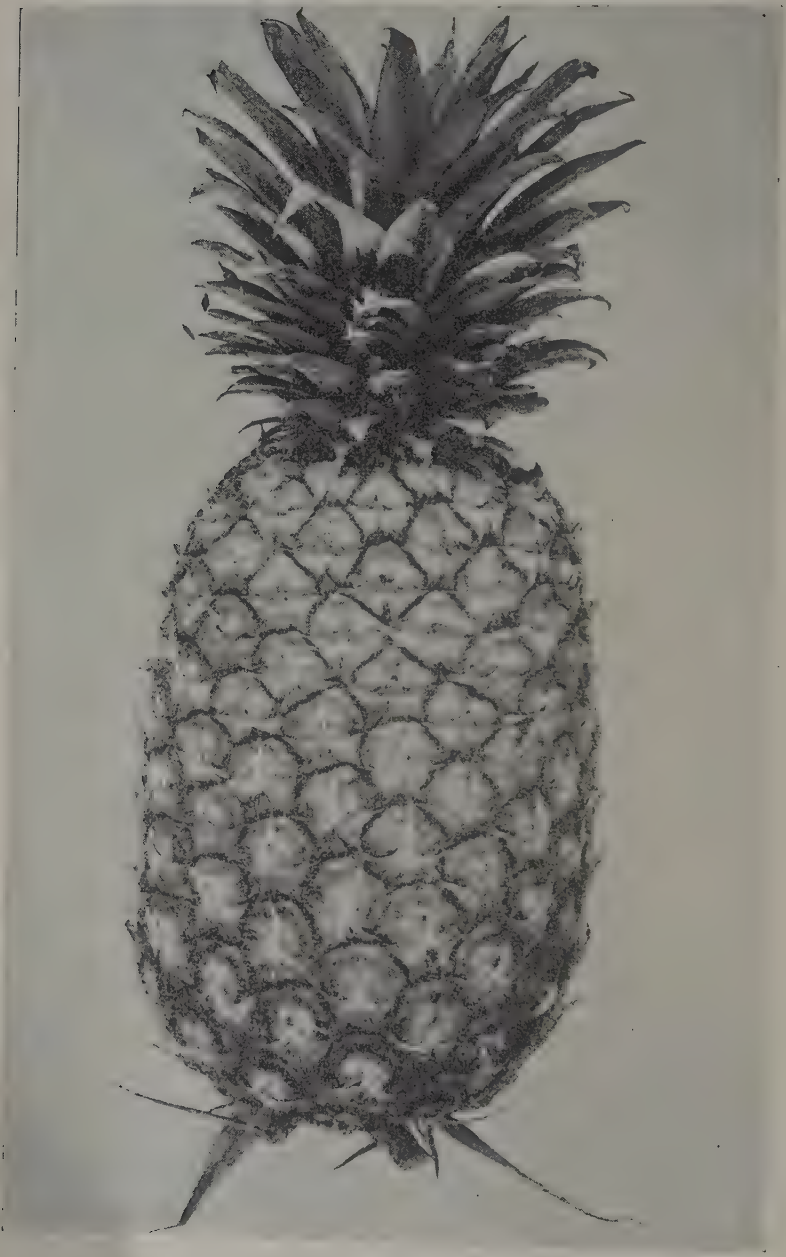

Plate 2.
THE SMOOTH CAYENNE PINEAPPLE.

these tendencies are generally hereditary in character. Because they are smaller, fruits from ratoon fields are usually more cylindrical in shape than those harvested at the plant crop.

A fruit weighing around 6 lb. should have a diameter of approximately 5 inches and should taper slightly towards both ends, but more so towards the apex. It should measure between 8 and 9 inches in length, excluding the crown, and should have square shoulders. The surfaces of the fruitlets or ''eyes'' should be broad and flat and the tips of the protecting bracts should project only very slightly at the centres of the eyes. Externally, the colour of the ripening fruit is normally deep yellow or coppery-yellow at the base or on one side, shading to green on the other portions, but it tends to become fully coloured as the advanced stages of maturity are reached. The flesh of the fruit should be firm, close textured and juicy, and light yellow in colour. The flavour varies with the conditions under which the fruit is grown and, in South-Eastern Queensland, with the season of the year in which it matures. Summer fruits are generally sweet and full-flavoured in contrast to winter fruits, which are often sub-acid and insipid. The size of the crown varies widely under different nutritional conditions; in shade, or when the nitrogen supply is excessive, it may be as long as the fruit itself. The crown should be single and neckless. Preferably three but not more than four slips should be produced from low down on the fruit stalk and two to three suckers from low on the stem.

In south-eastern Queensland, fruits of the Smooth Cayenne variety mature throughout the year, but chiefly during the months of February, March and April (summer crop), and July, August and September (winter crop). Occasionally, abnormally dry conditions during the early summer months may so delay flowering that the ripening of the main winter crop extends well into October. Fruits which mature between the summer and winter cropping periods are known as ''intermediate,'' and these are absorbed almost entirely by the fresh fruit trade, often at relatively high prices. Intermediate fruits are scarcest during the months of December and May, but the recent introduction of an artificial method for inducing flowering at pre-determined periods is now tending to relieve the customary market shortages during these months, particularly that experienced in May.

VARIETIES OF THE QUEEN GROUP.

The Queen variety was probably the first to be brought under cultivation, and it is said to have been grown in England under hothouse conditions as early as 1688. The delicate and distinctive flavour of most of the varieties belonging to the Queen group have long made them highly prized for table use in all tropical countries, but they have a limited market value because of their relatively unattractive appearance, small size and generally poor shipping qualities. In Queensland, however, where their merits have long been recognised, they are preferred for dessert purposes to the Smooth Cayenne, although this preference does not extend to the Southern States. Varieties of the Queen type are not now used for canning in Queensland, but a strain of the Queen variety known as the ''Natal'' is used to a limited extent for this purpose in South Africa.

The first pineapples grown in Queensland were probably of the Queen type, of which two varieties have been introduced, namely, the

Queen proper, locally known as the Rough-leaved or Common Rough, and the Ripley Queen. Apart from the Smooth Cayenne, these two varieties, or selections from them, are the only ones now cultivated commercially in Queensland. The Abachi and the Pernambuco are two other varieties of the Queen class which are highly prized for dessert purposes in some countries.

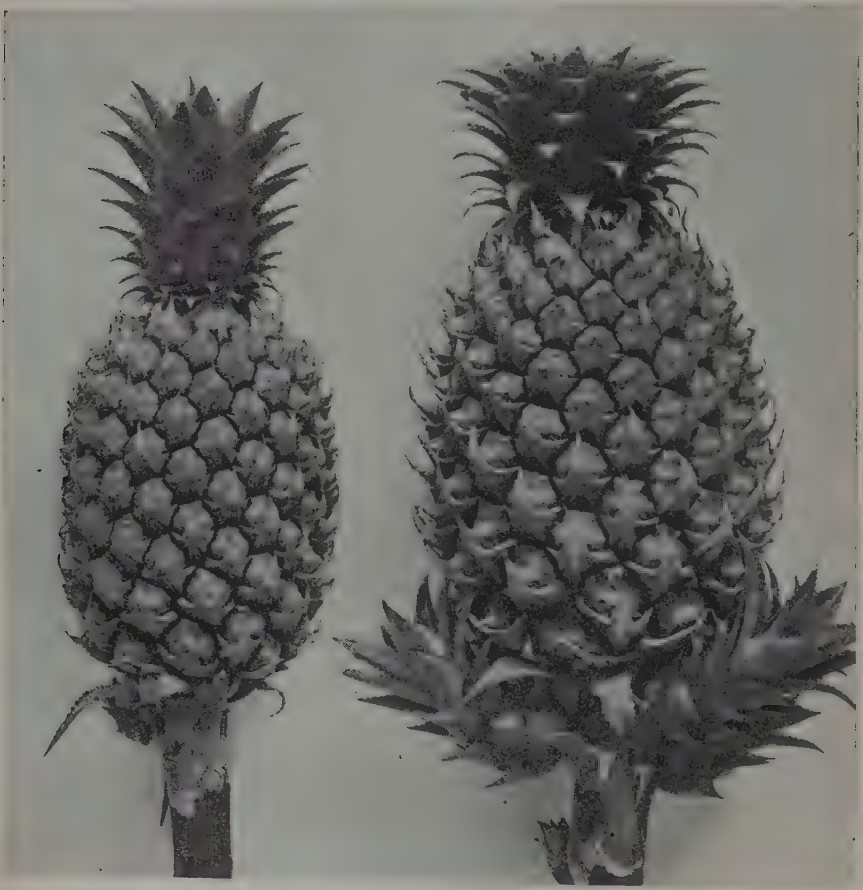

Plate 3.

ON THE LEFT, A FRUIT OF THE QUEEN VARIETY; ON THE RIGHT, ONE OF THE RIPLEY QUEEN VARIETY.

The salient characteristics of the varieties included in the Queen group are as follows:—The habit of growth is dwarf and compact. The leaves are short, broad and stiff, strongly serrated along the margins, and thickly covered with "meal" on both surfaces. The flowers are lilac in colour. According to the variety, the shape of the fruit varies from conical to cylindrical. The eyes are small and pointed and slope upwards. The fruit is bright yellow when fully ripe. The flesh is light yellow, opaque and porous, but it is firm and crisp, sweet, and of a distinctive and very agreeable flavour. The core is small and the crown compact.

The Ripley Queen variety is considered to have originated as a selection from the Queen, which it closely resembles in many respects. It differs chiefly in the colour of its foliage, which is pale green heavily tinged with red, in contrast to the bluish-green foliage of the Queen, and also in the shape of the fruit, which is generally thicker in proportion to its length than that of the Queen (Plate 3). A tendency to a conical shape is common to both varieties during a dry season. Other differences noticeable in Ripley Queen fruits are the flatter crowns, the somewhat larger eyes—the centres of which are characteristically covered with "meal"—the paler colour of the skin, the firmer and more porous flesh and the richer flavour. Both varieties are less juicy than the Smooth Cayenne. Although both Queen and Ripley Queen fruits are on the small side, those of the latter variety average slightly the larger of the two. From plant crop fields, fruits ranging in weight from 2 to 5 pounds are obtained. Large specimens rarely weigh more than 5 pounds and old ratoon fields, particularly those of the Queen variety, commonly produce very small fruits unless rigorous thinning of the suckers has been carried out. Extremely prolific suckering is a characteristic exhibited by both varieties when grown under favourable conditions.

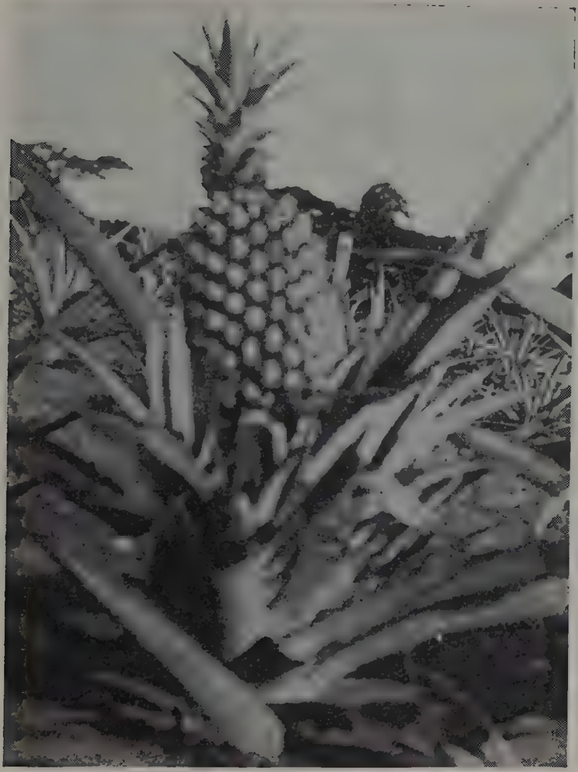

Plate 4.

PLANT OF THE MACGREGOR VARIETY.—Showing the characteristic sturdy, compact habit of growth, free suckering tendency and blocky type of fruit.

Most of the varieties included in the Queen group, as well as those in other groups, have originated from individual bud sports by a process of selection and propagation. Two varieties which have originated locally in this way and which are now well established in Queensland are the MacGregor, a selection from the Queen, and the Alexandra, a selection from the Ripley Queen.

The MacGregor, which originated at Bulimba, was introduced by Mr. E. Smallman of Ormiston about twenty-five years ago, and was named after Sir William MacGregor, then Governor of Queensland. It differs from the Queen or common rough-leaved variety chiefly in its sturdier, broader-leaved and more vigorous habit of growth and its larger and better-shaped fruit (Plate 4). The tendency of the typical Queen variety to produce conically-shaped fruit during dry weather is much less pronounced in the MacGregor. Well grown MacGregor fruits average about 4½ pounds in weight. As they possess exceptional carrying qualities for a pineapple of the Queen class they are particularly suited for supplying to the far western districts of Queensland, where these varieties are in demand.

Plate 5.

TWO-YEAR-OLD PLANTATION OF THE QUEEN VARIETY ON MAGNETIC ISLAND, NORTH QUEENSLAND.

The Alexandra was selected from the Ripley Queen variety by the late Mr. Bromiley, of Nikenbah. Like the MacGregor, this sub-variety possesses several points of superiority over its parent variety, notably a more vigorous constitution and larger-sized fruit. The eyes are somewhat flatter and, while retaining the relatively large diameter which is typical of the Ripley Queen, the fruit is more cylindrical and square at the shoulders. The skin of the mature Alexandra fruit is paler in colour than that of the Ripley Queen and not infrequently it is little deeper than a light yellow-green. The Alexandra is said to carry better than the true Ripley Queen, though not as well as either the Queen or the MacGregor and, because of its larger average size and superior eating quality, it generally commands high prices in the markets.

Both the Ripley Queen and Alexandra varieties are particularly subject to the physiological disorder of pineapples known as ''black heart'' and, in consequence, these varieties are practically unsaleable in south-eastern Queensland during the winter months. As compared with the Queen or MacGregor, the Ripley Queen is a relatively delicate variety and is highly susceptible to an unfavourable growth environment. In suitably moist but well drained soils, however, it responds to fertilizing to a marked degree, using fruit weight and size as a criterion.

For some years past, none of the varieties of the Queen group have been marketed to any extent outside of Queensland as the interstate trade prefers the Smooth Cayenne, presumably on account of its larger average size, more attractive appearance and better carrying and keeping qualities. Consequently, these varieties are mostly grown adjacent to centres of population for local consumption only: in south-eastern Queensland their cultivation is confined almost entirely to the rural districts included in the Greater Brisbane area. During November-December and May-June, however, when supplies of the Smooth Cayenne from south-eastern Queensland are at a minimum, several thousands of cases of the Queen variety are shipped to Sydney from Magnetic Island in North Queensland and find a profitable market (Plate 5).

VARIETIES OF THE SPANISH GROUP.

The type variety of the group is the Red Spanish and this is the principal variety grown for the United States fresh fruit trade in Cuba, Puerto Rico and Florida. The variety chiefly used for canning in Malaya is also said to be similar in type to the Red Spanish, but it differs from the West Indian variety of that name in that it has smooth-edged leaves. In world commerce, the varieties included in this group probably rank second in importance to the Smooth Cayenne.

The Red Spanish and several other varieties of the same group were introduced into Australia many years ago by the Queensland Acclimatisation Society but failed to become established in favour. A few plants of the Red Spanish variety are still to be found growing in private collections. The chief merits claimed for the Red Spanish variety are its hardy, vigorous constitution and the ability of the fruit to withstand relatively rough handling and long shipment.

The Red Spanish plant is vigorous and erect, with long narrow, spiny leaves, characteristically dark green in colour and often tipped with red. The fruit is typically squat, possessing a large diameter in relation to its length, and generally appears somewhat barrel-shaped. The eyes are large and flat but few in number, which tends to make the fruit appear smaller than it is. Red Spanish fruits usually contain only eighty or ninety eyes, which is approximately half the number in a well grown Smooth Cayenne fruit. Fruits of aver[illegible] weigh from 2½ to 3 pounds. When ripe, the skin colour is deep yellow, generally suffused with red. The flesh is juicy, white or pale straw coloured and pleasantly sub-acid in flavour. In Florida, the flavour of the Red Spanish variety is regarded as inferior to that of other varieties, but for market purposes it is considered that this disadvantage is more than offset by its excellent shipping qualities.

Besides the Red Spanish, other varieties or strains classed in this

Chapter IV.—IMPROVEMENT OF THE PINEAPPLE BY BREEDING AND SELECTION.

Most of the crop plants now in cultivation are not readily identifiable with the primitive types from which they have originated because of the improvements which have gradually taken place in their productivity, whether of roots, leaves, fruits, or other organs possessing economic value. These improvements have been effected either through cross-fertilization to produce new hybrid varieties from seed, or through the perpetuation, by selection and propagation, of individuals or shoots exhibiting new and desirable characteristics.

Practically all of the varieties of pineapples now in cultivation are considered to have arisen as bud sports from more primitive types, and most of them originated in Central America or the West Indies. During the eighteenth and nineteenth centuries a number of hybrid seedling varieties were raised in European hothouses, but few of these remain in cultivation to-day. No new pineapple of any commercial importance has been introduced into general cultivation for more than a century, apart from selections of the three basic varieties, viz., Smooth Cayenne, Queen, and Red Spanish. During recent years, however, renewed and increasing attention has been given to hybridization as a means of producing new varieties from seed. Work of this kind is now being carried out in Hawaii, Florida the Philippines and, to a lesser extent, in South Africa and Malaya. At the same time, intensive efforts are being directed towards the improvement of existing varieties, particularly the Smooth Cayenne, by the selection and vegetative propagation of plant types exhibiting superior characteristics.

RAISING NEW VARIETIES FROM SEED.

No organised programme of pineapple breeding work has yet been attempted in Queensland, although seedlings have been raised at various times from chance seeds occurring in pineapple fruits. None of the plants raised in this way has shown any particular merit, but progeny of one of them, known as Commonwealth Seedling, are still in existence in the gardens of the Queensland Acclimatisation Society at Lawnton. In Hawaii and the United States, endeavours to obtain new varieties by the use of chance seed have long been abandoned in favour of carefully planned hybridization, because chance seedlings exhibit unpredictable and usually inferior characteristics.

The major objectives sought in pineapple breeding work for the production of new varieties are greater plant vigour, increased resistance to disease, higher productivity and superior fruit characteristics. The difficulty, of course, is to combine all of the desired qualities in a single hybrid. For work of this kind to be tackled on a scale that permits of it having a reasonable prospect of ultimate success not only is painstaking effort over a long period of years required, but also a heavy maintenance expenditure, since a period of approximately three years elapses from the time the seed germinates until the first fruit matures.

In Hawaii, it has been found that practically all of the known varieties of pineapple are of value in breeding work, whether grown commercially or not. Some of the primitive varieties with worthless fruits possess desirable plant characteristics, such as disease resistance and superior root development and, in consequence, are used extensively for breeding purposes. Fertilization of the flowers of the female parent of a cross is effected by hand pollination and the seeds are obtained from the fruit after it is mature. Crosses are not made haphazardly but on a strictly genetical basis; backcrossing of a hybrid with one of its parents is frequently resorted to.

Propagation of pineapples from seed is almost as difficult as that of orchids and calls for the same care. The seeds are encased in a thick, tough, protective coat, and to facilitate germination this is softened before planting by soaking them in strong acid. The seeds are sown on moist sterilized sand in shallow trays and maintained at a temperature of 90 degrees F. Germination takes place in about ten days. When six weeks old, the young seedlings are pricked out into flat boxes fitted with collapsible bottoms, but they are not removed from the glasshouse until 4½ months later. On removal from the glasshouse they are hardened off in a lath house and again transplanted to larger boxes to give them more room for development. When they are twelve to fifteen months old they are planted out in the field, the collapsible bottoms on the boxes permitting this to be done with a minimum of root disturbance or injury. The fruits mature about two years later.

Plate 6.

HYBRID PINEAPPLE SEEDLINGS BEING "HARDENED OFF" IN A LATH HOUSE AT THE EXPERIMENT STATION OF THE HAWAIIAN PINEAPPLE PRODUCERS' CO-OPERATIVE ASSOCIATION PREPARATORY TO BEING PLANTED OUT IN THE FIELD.

At the Experiment Station of the Hawaiian Pineapple Producers' Co-operative Association more than 100,000 hybrid seedlings are raised yearly (Plate 6). Except for those which exhibit a weak or spindly type of growth and are discarded early, each of the seedlings is kept under observation until it fruits, since each has a different genetic constitution. The number of these kept for further observation or for breeding purposes after the plant crop has matured varies greatly with the cross; in some it may be less than one per cent., while in others it may exceed ten per cent. In selecting seedlings for further trial, particular emphasis is laid on the canning quality of the fruit.

Once a desirable hybrid has been obtained—and this may require systematic crossing through a number of generations—its further propagation can be carried out only by vegetative means. Even when special methods of propagation are employed, it takes five or six years to obtain sufficient planting material of a new hybrid to plant up one acre. Consequently, the production of new pineapple varieties by cross-fertilization must be regarded as a long-range project and one that is entirely beyond the scope or resources of the average grower.

IMPROVEMENT OF THE PINEAPPLE BY SELECTION OF VEGETATIVE PLANTING MATERIAL.

Only plants which are self-fertilized come true to type when grown from seed; those in which cross-pollination takes place give rise to hybrids. Since the pineapple is normally self-sterile, perpetuation of given varieties or types can be effected only by vegetative methods of propagation. In practice, this is accomplished by planting the various types of offshoots—suckers, slips, and crowns—which arise from a parent stem, or even this stem or "butt" itself. Usually, plants propagated in this way reproduce only the characters possessed by the parent. In a small proportion of the buds from which offshoots develop, however, some of the characters of the parent may be missing or new ones may arise with the result that plants propagated from them differ in varying degree from the parent type. Variations of this kind are known as *mutations* or "bud sports" and are inheritable. The conditions which cause them are not clearly understood, but they should not be confused with the variations in growth or fruiting characters which result from environmental influences, as, for example, the contrasting types of growth which develop under conditions of light and shade. These latter are known as *acquired characters* and are not strictly inheritable, although the conditions under which a plant is grown are often reflected in its progeny, viz., shoots produced by vigorous parents develop into sturdier plants than those taken from weak-growing or diseased stock.

Accidental Selection as a Factor in the "Running Out" of Varieties and the Development of Varietal Strains.

Most of the variations which arise in the form of mutations are so minute as to be imperceptible, but some may be pronounced and thus sharply differentiate the shoot from its parents. In vegetatively propagated plants these differences, however slight or extreme, are perpetuated by planting the shoots which exhibit them. Consequently, unless discrimination is exercised in the choice of planting material, a pineapple variety tends to undergo a gradual but continuous change in successive generations, due to the fact that the types which produce shoots freely are propagated at a faster rate than those which do not. In other words, there will be *accidental selection* of these types. This tendency largely accounts for the so-called "running out" of varieties or strains which sometimes takes place when the same stock is propagated continuously on one farm or in one district over a period of years. What actually happens in such cases is that cultural practices and local environmental influences favour the multiplication of certain undesirable mutations which, if not rigorously culled, will in time supplant the original varietal type. Where deterioration of stock in this way has occurred, its replacement by planting material obtained from another farm or locality will remedy the position only if the new stock is both more vigorous and of an inherently better type than that which it supersedes. Obviously, therefore, the source from which planting material is obtained is a matter of the greatest importance, though one which is frequently overlooked or ignored.

As a result of accidental selection, a variety which has been grown for a long time in one country or region may exhibit characteristics which distinguish it from the same variety as grown in another country, although in both instances the original supplies of planting material were derived from the same source. Modifications in cultural practices which have been imposed by local conditions are often an important though unrecognised factor in the development of these varietal strains. In the older-established pineapple districts of south-eastern Queensland, slips have not been greatly used for the propagation of the Smooth Cayenne variety until quite recently, because, in this region, slips are produced chiefly in association with fruits which mature during the summer months, while planting is carried out preferably during the spring, after the cold weather has passed. In certain low-rainfall areas in North Queensland, however, particularly around Bowen, slips have always been extensively employed for propagating purposes, since it has been found that the best time for planting in these warm, dry latitudes is during the rainy season which follows the harvesting of the main summer crop. For this reason, the type of plant which now predominates in Bowen plantations is one which is characterised by a much greater tendency to slip production than is inherent in the type commonly grown in the southern part of the State.

The mutations which tend to become predominant in any locality or region as a result of accidental selection are not necessarily undesirable from an economic standpoint. The Natal strain of the Queen variety is a free-suckering, sparsely-slipping type which probably originated in this way, and the relatively low incidence of the objectionable "collar-of-slips" type in Smooth Cayenne plantations in southern Queensland is attributable to the traditional use of suckers for propagating purposes in this locality.

Principles Underlying the Practice of Plant Selection.

From the foregoing, it will be apparent that the accumulation of mutations in a pineapple variety results in a gradual but cumulative divergence from type. Because all mutations are hereditary, however, it follows that their perpetuation can be prevented or accelerated at will by appropriately restricting the choice of planting material. Limiting the choice of shoots for propagating purposes to those produced by plants whose characters it is desired to perpetuate is properly known as *artificial selection* in contrast to selection effected by natural or accidental causes, though artificial selection is generally implied whenever the term "selection" is used alone. Careful and repeated selection is necessary not only for the maintenance of the original characteristics of a pineapple variety, but it is also the only means whereby those original characteristics may be modified or improved. Maintenance involves the elimination of all inferior mutations, while modification or improvement is effected by selective propagation of individuals possessing distinctive or superior characteristics.

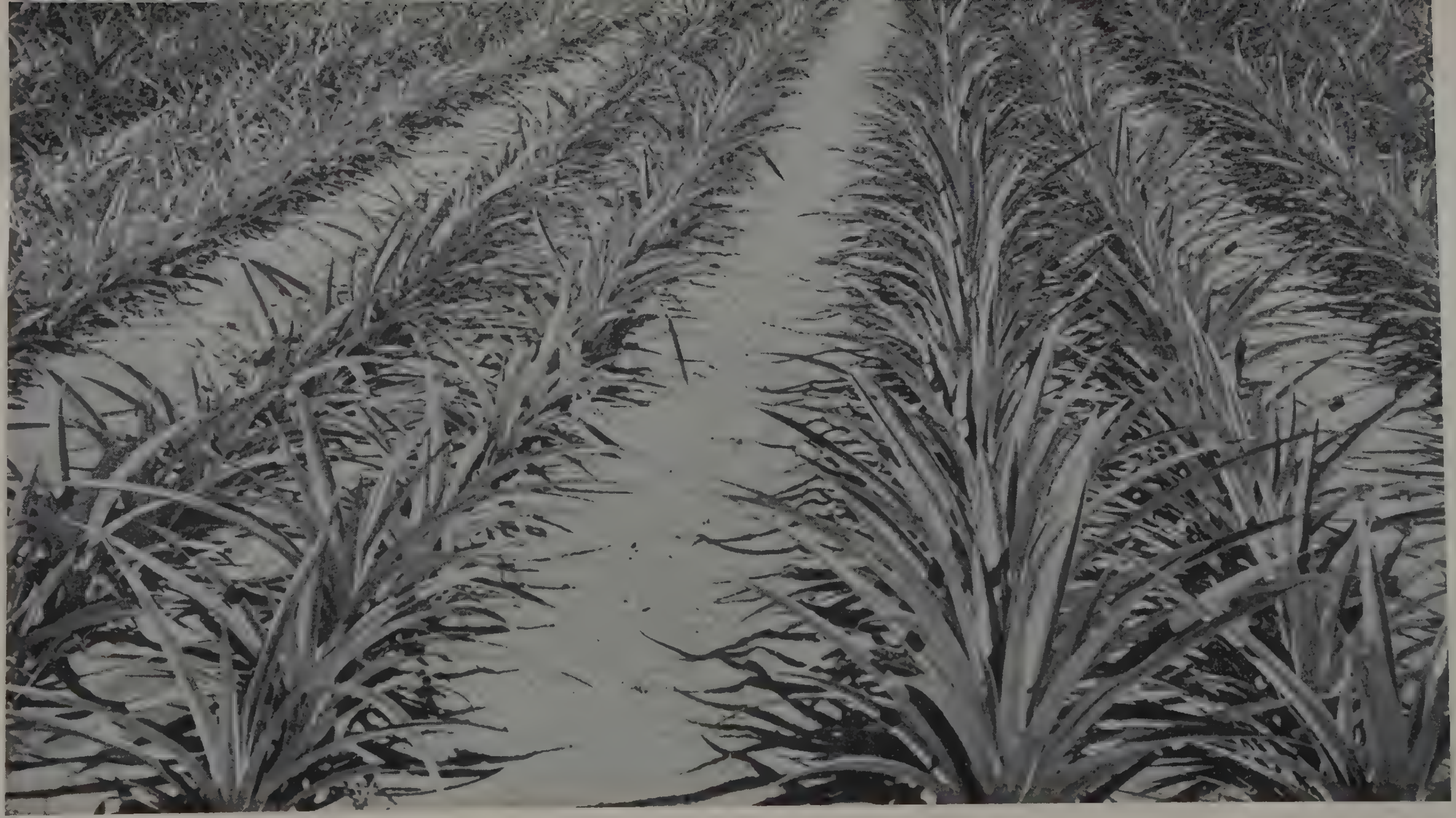

Plate 7.

DEMONSTRATION OF TRANSMISSION OF VIGOUR.—Slips planted in double row on left obtained from chlorotic plants; those on right from vigorous green plants. Both lots of slips were of same average weight at time of planting.

Hereditary versus Acquired Characters.

In practising selection, it is desirable to be able to distinguish between hereditary variations and those which result from environmental influences. This distinction is not always easily made, since certain growth characters may originate from either one of these causes; for example, differences in leaf colour and in vigour of growth. For all practical purposes, however, minute variations in form or colour which do not perceptibly influence the productivity of the plant may be disregarded in carrying out a selection programme, cognizance being taken only of those characters which it is desired to eliminate or perpetuate. Relative vigour of growth falls into this category, and a clear conception of the manner in which this factor influences the expression of hereditary characters is necessary for a full appreciation of the principles underlying practical selection methods.

Transmission of Vigour.

In vegetatively-propagated crop plants, such as the pineapple, hereditary variations which are sub-normal in vitality tend to be self-eliminating, because they produce relatively few shoots whereby the type may be perpetuated. In general, therefore, lack of vigour is indicative of an unfavourable environment. This point is of especial significance because it has been conclusively demonstrated that the vigour of the parent stock greatly influences the growth rate and productivity of its progeny. Planting material from wilt-affected plants is strikingly more backward in growth and of lower productivity than that from healthy stock. Similarly, planting material from chlorotic plants is definitely inferior to that taken from plants possessing an abundance of chlorophyll in their leaves, because the amount of starchy substances contained in the stem of a shoot determines the rate and extent of the root development which takes place when it is planted (Plate 7).

Since plants which have been propagated from weak parent stock are sub-normal in vitality, the off-shoots which develop from them are also lacking in vigour. In this way, a modification in vigour of growth resulting from environmental influences, i.e., an acquired character, may be carried through several successive generations. In contrast to those due to inherited tendencies, however, acquired characters do not persist indefinitely, as the descendants of the plants which originally acquired them gradually revert to the average level of growth permitted by the existing environment. Nevertheless, it will be obvious that rejection of all weak-growing, ill-nourished or diseased plants as sources of planting material will have an immediate effect in raising yields. Selection is thus equally desirable with respect to acquired characters as it is with hereditary ones. In addition, undesirable hereditary characters may frequently escape notice in weak-growing plants owing to the masking effects of reduced vigour. For these reasons, it is bad practice to rely on old ratoon fields as the principal sources of planting material, since old ratoon plants are almost invariably undernourished and lacking in vigour, as compared with those which have borne only one fruit. This is indicated by the relatively small-sized fruits which ratoon plants produce. Quite apart from this, however, it is exceedingly difficult to distinguish between healthy and diseased plants in ratoon fields and almost impossible to accurately assess their vegetative and fruiting characters. As already indicated, disregard of the vigour of the parent stock from which planting material is taken is an important factor contributing to the "running out" of varieties.

Objectionable Vegetative Mutations.

Of the many different kinds and degrees of inheritable variations which occur in the pineapple only a small proportion of the defective types have any real practical significance. Although these are generally of exceptional vigour, their importance is measured not merely by their ability to survive but also by their reproductive capacity assessed in terms of the number of slips or suckers which they produce. Consequently, the types which are most objectionable are not necessarily the ones which exhibit the most worthless characters, but those in which defective characters are associated with a high reproductive capacity. When the capacity for vegetative reproduction exists in an extreme form, as it does in the "collar-of-slips" type, it may in itself become highly undesirable. Objectionable vegetative mutations occurring in Queensland plantations include the following—

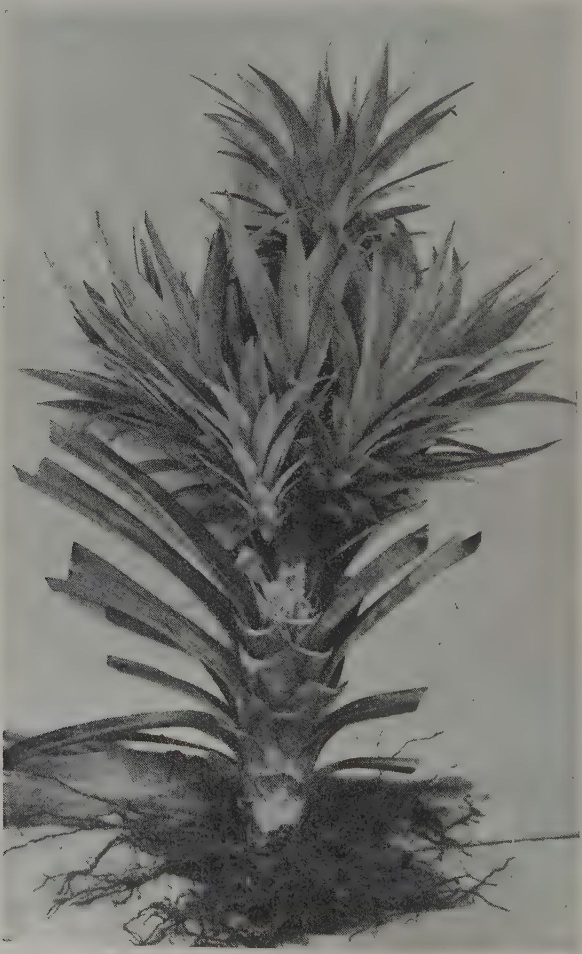

Plate 8.

TYPICAL "COLLAR-OF-SLIPS" PLANT WITH LEAVES CUT AWAY TO SHOW TOTAL ABSENCE OF SUCKERING.—Note that the fruit is completely hidden by the encircling slips.

"**Collar-of-Slips.**"—As the name implies, this mutation is characterized by the production of an encircling ring of slips crowded closely around the base of the fruit, the number of slips produced being generally more than double the average for normal plants (Plate 8). However, the degree and manner in which this tendency may be expressed is greatly influenced by environmental conditions. In Hawaiian plantations the collar-of-slips tendency is often masked at higher, that is, cooler elevations. In Queensland it occurs in characteristic form only during the late summer months, and then chiefly in plant crop fields. At other times of the year, plants in which the tendency is inherent rarely produce more than three or four slips on the fruit stalk and, in some, slip production may be entirely suppressed. Even during the summer, the expression of the "collar-of-slips" tendency may range from a profuse development of slips down

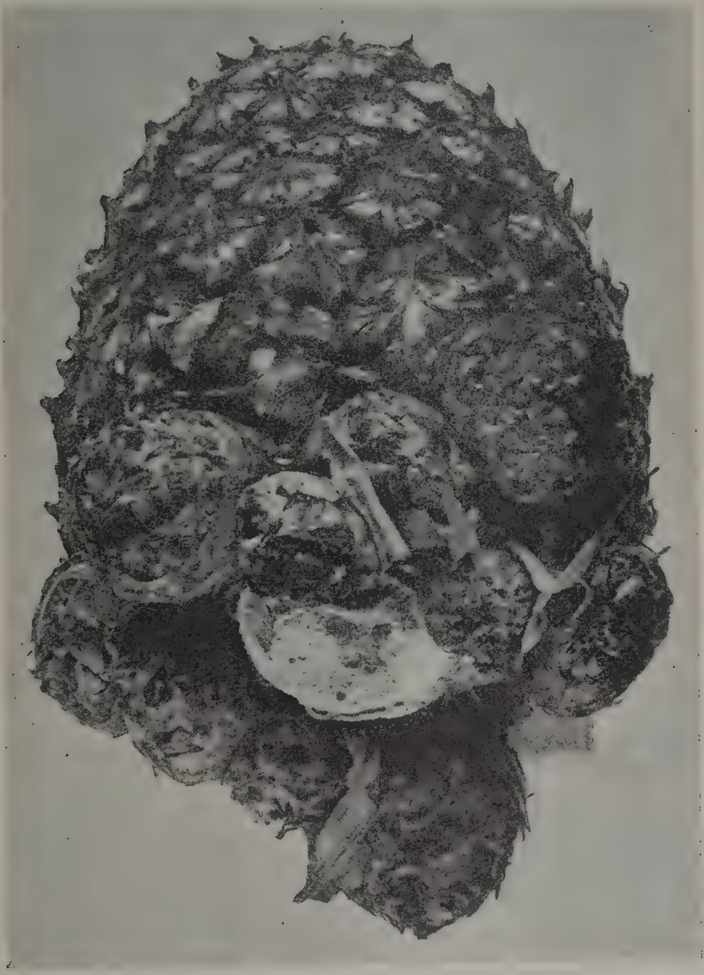

Plate 9.

KNOBBY OUTGROWTHS PROTRUDING FROM THE BASE OF A FRUIT WHICH WAS PRODUCED ON A PLANT POSSESSING THE "COLLAR-OF-SLIPS" TENDENCY.

to an apparently normal type of plant. Except in the latter case, fruits produced on "collar-of-slips" plants usually possess knobby outgrowths protruding from their bases (Plate 9). This tendency, like that relating to slip production, is also extremely variable in expression; knobby fruits may be produced both on "collar-of-slips" plants which are seemingly normal in type as well as on some which do not possess the collar tendency.

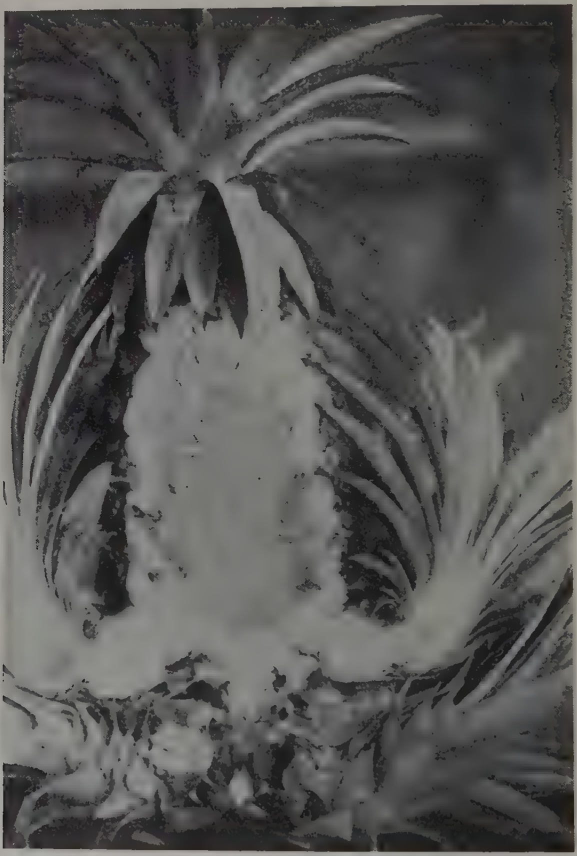

Plate 10.

"COLLAR-OF-SLIPS."—Sectional view showing slips originating from the base of the fruit (cf. Plate 11).

Arbitrary distinctions are made between various expressions of the "collar-of-slips" mutation although the differences are seldom clearly defined. When one or more of the encircling slips arises directly from the base of the fruit the plant is said to exhibit a typical "collar-of-slips" condition (Plate 10); when none is attached to the fruit itself although an excessive number is clustered around its base, the plant is said to be of a "near-collar" type (Plate 11). These two types are often indistinguishable until after the fruit has been picked. A third distinction is sometimes made with regard to plants in which the abnormal slipping tendency is not evident although the fruits which they produce are knobby, but, as previously remarked, knobby fruits are not produced solely by "collar-of-slips" plants. Since all three of these types are merely different gradations of a single inherited tendency, plants propagated from any one of them may reproduce either the characters of the parent or they may exhibit those of one of the other types or of a normal plant. However, the percentage of apparently normal types resulting from "collar-of-slips" parents is generally considerably less than it is from "near-collar" or "knobby" parents (Plate 12).

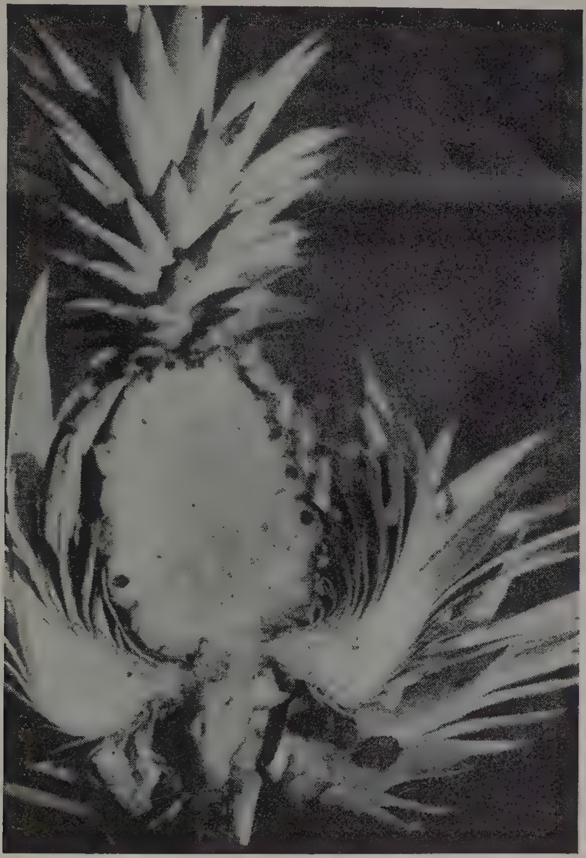

Plate 11.

"NEAR COLLAR-OF-SLIPS."—Sectional view showing slips arising close to but not directly from the base of the fruit (cf. Plate 10).

While the fruits produced on "collar-of-slips" plants are not inferior in quality to those from normal plants, they are usually smaller in size and apt to be conical in shape with prominent eyes. The plants which bear them are vigorous and erect in habit, but the production of suckers is generally retarded and those which do develop usually arise from high on the parent stem. In the Smooth Cayenne variety, the "collar-of-slips" is a delayed fruiting type and not only is the plant crop late in maturing, but, in ratoon fields in which it is prevalent, there is always a high percentage of "holdover" suckers which have failed to flower.

Consequently, the presence of appreciable numbers of "collar-of-slips" plants in a field depresses the yield, not only because the average size of the fruits is smaller, but also because fewer fruits are harvested.

"Collar-of-slips" is regarded as the most objectionable "off" type occurring in Smooth Cayenne plantations. Since the mutation itself occurs very rarely, however, the prevalence of the type has resulted almost entirely from propagation of slips or crowns produced on plants in which the tendency is inherent. Consequently, its elimination can be effected by rigorous selection over a number of generations: provided this is properly carried out, there need be no fear of its recurrence. "Collar-of-slips" is an especially mischievous variation from type in that it offers an obvious and very prolific source of planting material and for this reason it is apt to multiply very rapidly in plantations where no precautions are taken to prevent its propagation.

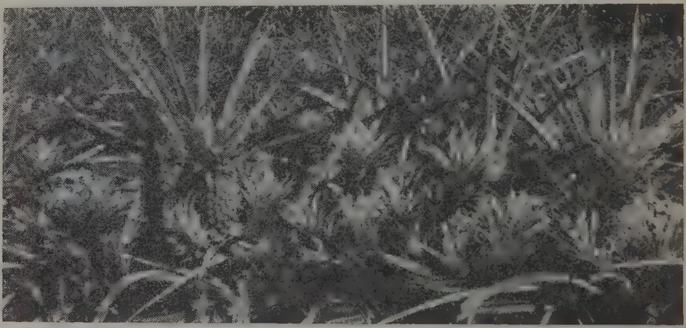

Plate 12.

FIVE PLANTS PROPAGATED FROM A SINGLE "COLLAR-OF-SLIPS" PLANT, ALL EXHIBITING THE CHARACTERS OF THE PARENT.

Because the "collar-of-slips" tendency is so variable in its expression it is not practicable to completely eradicate it from a plantation in the course of a single generation. The simplest method of effecting its gradual elimination is to consistently break off all slips from plants exhibiting the tendency while the fruits are still immature, whether the tendency be expressed as a "collar-of-slips" or in the form of knobby fruit. This will not only forestall any subsequent temptation to use such slips as planting material, but will also have a beneficial effect on the developing fruit and suckers, provided the removal of the slips is effected before the fruits are two-thirds grown. If there is any likelihood of the crowns being required for propagating purposes, those on "collar-of-slip" fruit should be marked with a dab of white paint at the time the slips are removed so that they may be readily distinguished later and rejected. Since the "collar-of-slips" tendency is typically expressed in the production of an *excessive* number of slips, however, its propagation may be greatly reduced by arbitrarily rejecting as sources of planting material all plants carrying more than the normal number, i.e., three or four. This method may be usefully employed when selection during the period of fruit development has been omitted, as it may be carried out even after the crop has been harvested. If delayed until this time, however, it suffers from the disadvantage that no regard can be given to knobbiness of the fruit as an expression of the "collar-of-slips" mutation. Still another arbitrary method of selection for the elimination of this objectionable type is to use as sources of planting material only plants which bear early maturing fruit, since the "collar-of-slips" type is characteristically late fruiting. However, all three of these methods for eliminating "collar-of-slips" plants are effective only if (1) they are carried out for several successive generations; (2) all planting material is taken from plant crop fields; and (3), except in the case of the third method, suckers are not used for propagating purposes. Furthermore, they can be successfully applied only during the summer months, since at other times of the year the "collar-of-slips" tendency is apt to be masked. For this reason, it is inadvisable to plant *any* slips which may develop in association with winter-maturing fruit.

The methods which are employed for the selection and propagation of superior types or strains of pineapples afford more positive means for the elimination of the "collar-of-slips" mutation than those which have been described, but they also involve a considerably greater amount of labour. Two of these methods are outlined in a subsequent section of this chapter.

Spiny Leaves.—Reference to this character has already been made in Chapter II. It is the most frequently occurring mutation in the Smooth Cayenne variety. If the cell differentiation leading to spininess occurs sufficiently early in the development of the sucker, slip or crown to affect all of the leaves the character is definitely inheritable; if only a leaf, or part of a leaf, is affected the character may not be transmitted. Spiny-leaved plants are objectionable from a cultural standpoint. Planting material of the Smooth Cayenne variety which exhibits the tendency should be rigorously rejected.

Pandanus Type of Plant.—This giant type is so named because it resembles the common screw-pine of the Queensland coast, in possessing a tree-like stem with buttressing roots. The leaves are shorter, wider, flatter and more numerous than they are in a normal plant, and incline to the parent stem at a much more acute angle. The plants are exceptionally vigorous growers, but flowering is usually very much delayed. Instances have been reported where flowering has not occurred until four years after planting, by which time the stem may have attained a length of three feet. The fruits are inferior in size. Isolated plants of this type occur fairly commonly in Queensland plantations, but as their propensities for both sucker and slip production are weak, the rate at which they multiply is slow. Indiscriminate choice of planting material from old ratoon fields is probably chiefly responsible for the propagation of the type, as it is unlikely that it is ever planted deliberately. The precautionary measures which should be taken to avoid propagation of this and similar worthless variant types are obvious.

Multiple and Fasciated Crowns.—These objectionable vegetative aberrations are generally regarded not as inheritable variations, but as expressions of an excessively lush rate of growth at the time of flower bud development. While this appears to be true for multiple crowns which are fused at their point of attachment with the fruit, another type has been recognised in the Bowen district in which each shoot making up the crown develops separately from its neighbours. Observations suggest that this latter type is hereditary. As shown in Plate 13 the shoots arise along the line of an arc which extends well down on the shoulders of the fruit on both sides. In conformation and size as well as in vegetative characteristics, the individual shoots closely resemble slips. The fruits are typically undersized and squat in shape, the eyes prominent and the bracts projecting. The plants themselves are vigorous, high-stemmed and high suckering; the leaves are long and erect. Slips are produced freely and a "collar-of-slips" tendency is often apparent. This characteristic may account for the observed predominance of the type in certain plantations. Pending confirmatory evidence from trial plantings, it is therefore considered advisable to regard this type of multiple top as hereditary and offshoots from plants which exhibit the tendency should not be used for planting material.

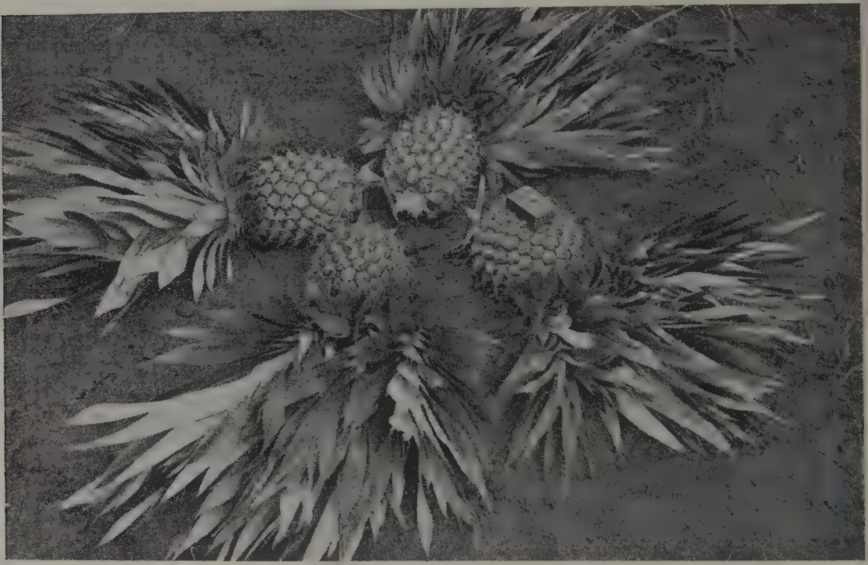

Plate 13.

A TYPE OF MULTIPLE CROWN WHICH IS PROBABLY HEREDITARY.

Defective Fruit Shapes.

While varietal characteristics and plant vigour are the chief factors determining fruit size and shape, fruits may occasionally develop which differ markedly from the normal, particularly as regards their diameter and length. In general, it may be assumed that extreme divergences from type are hereditary in character and, as such, they may be perpetuated or eliminated by selection. Objectionable aberrations of this kind occurring in Queensland pineapple plantations include the following:—

Slender Fruit.—The principal distinguishing feature of this type is its small diameter in relation to its length (Plate 14). Small diameter fruits are not only less suitable for canning than larger ones, but they also yield a smaller return to the grower, since it costs as much to produce a slender pineapple as it does a thicker and heavier one. In addition to being sub-normal in diameter, however, fruits of this type are generally rounded at the top and knobby at the basal end. The plants which

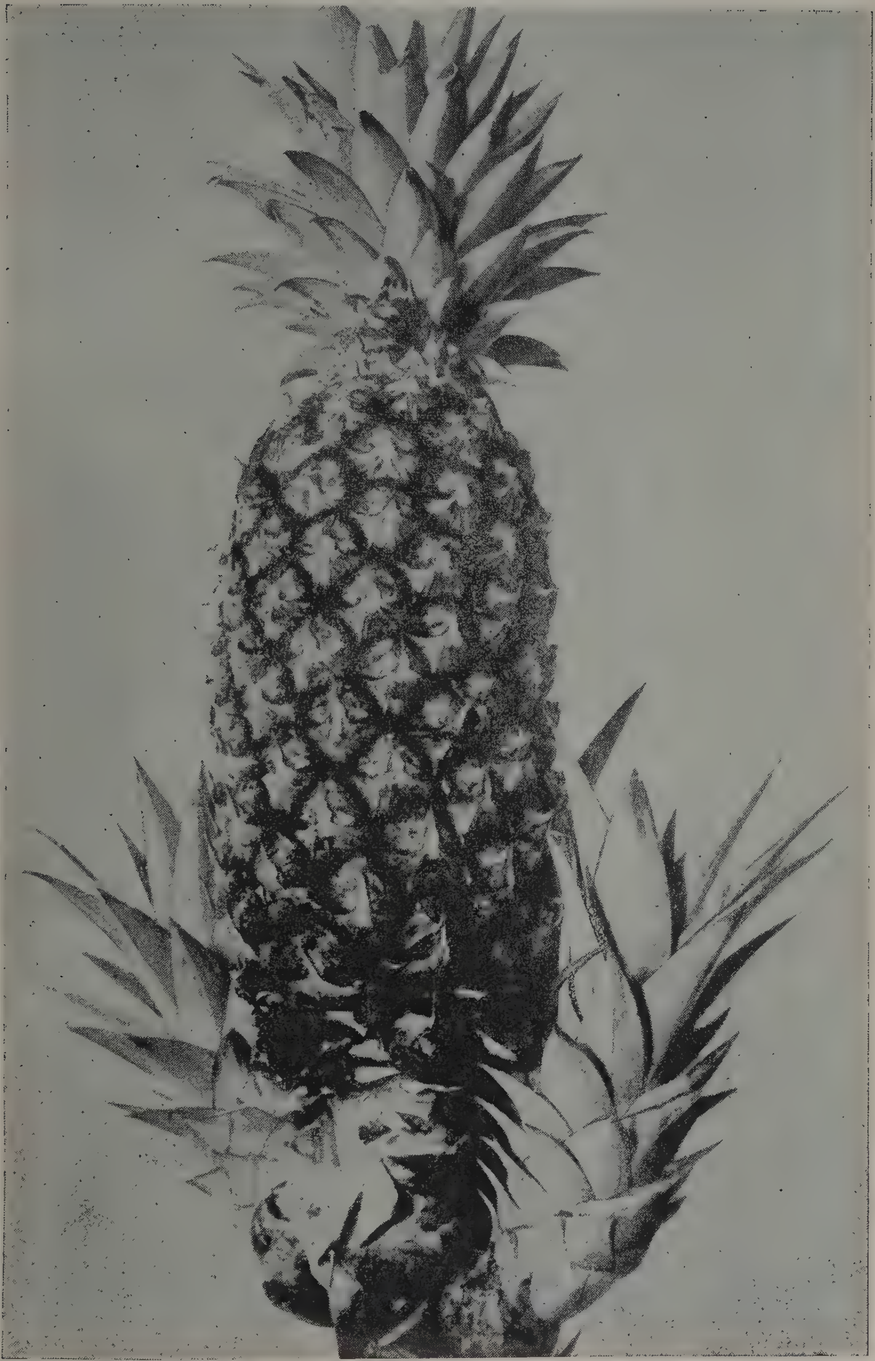

Plate 14.

THE SMALL DIAMETER MUTATION.—Note the knobs at the base of the fruit (cf. Plate 15).

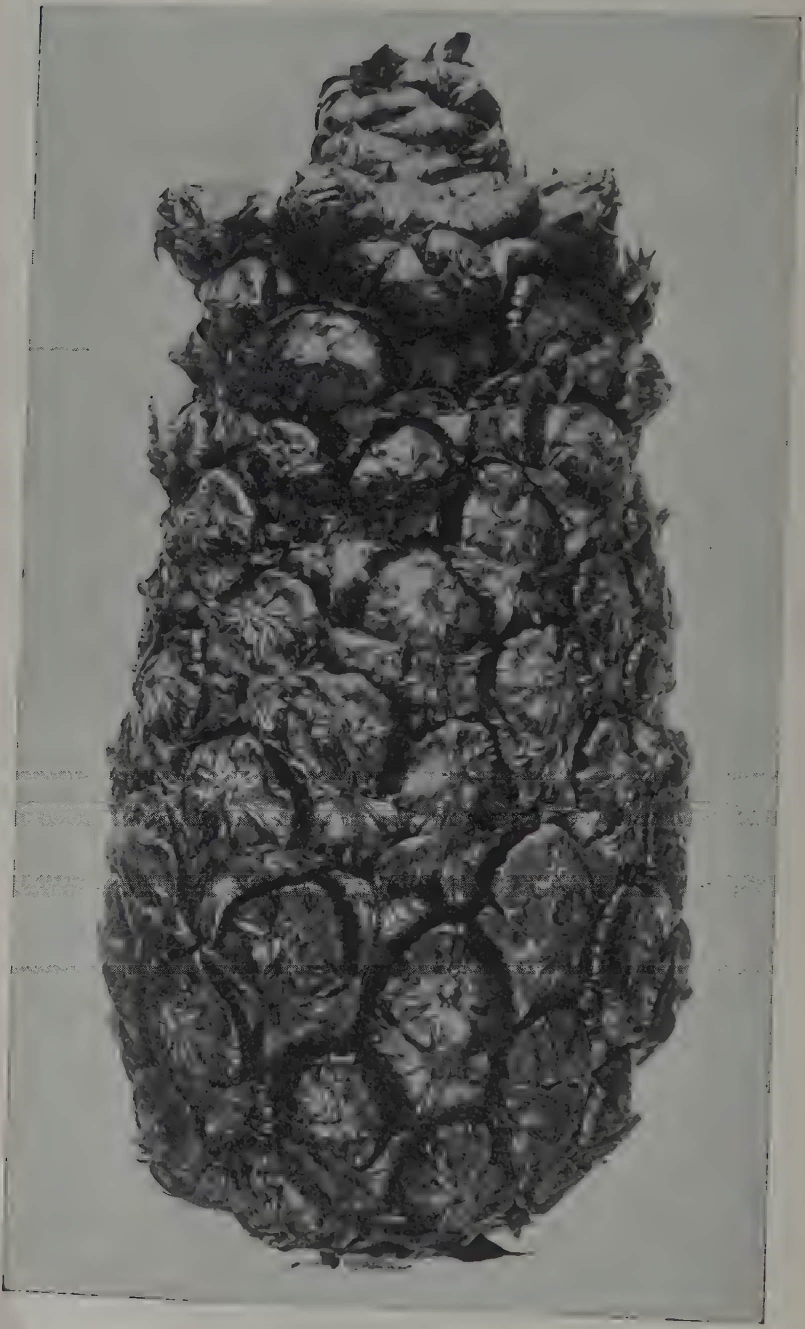

Plate 15.

THE "LONG TOM" MUTATION.—Note the abnormally large, flat eyes, some of which protrude at the top of the fruit to form "knobs" (cf. Plate 14).

produce them frequently exhibit a strong "collar-of-slips" tendency, although slips rarely develop from the fruit itself. Like the fruit which is produced on true "collar-of-slips" plants, the small diameter type is characteristically late in maturing, but, unlike "collar-of-slips," it exhibits little variation from generation to generation. Consequently, it is easily recognised in the plantation and its eradication may be effected with certainty by breaking off all shoots which might be used for propagating purposes while the fruit is still on the plant. This should be done as soon as the fruit has reached a stage of development at which the "small diameter" character becomes apparent. In vigorous plant crop fields, this precaution is often overlooked or ignored because small diameter fruits produced under such conditions, though obviously "off" type, are usually marketable. The small diameter mutation is typically free slipping, which probably accounts for its present preponderance in certain plantations in the Bowen district, where slips have always been the preferred type of planting material.

The "Long Tom" Type of Fruit.—Several years ago, claims were made that a type of Smooth Cayenne fruit which was being produced on a number of plantations in the Mary Valley was particularly suitable for canning purposes by virtue of its characteristically elongated shape. Locally, this type came to be known as the "Long Tom," and its propagation was widely advocated. After fairly extensive plantings had been made it was found that the "Long Tom" fruit, while generally satisfactory in the winter months, was frequently abnormally slender or misshapen during the summer. Sometimes these characteristics were so pronounced as to render the entire crop unmarketable. Even when the fruit was of a size acceptable for canning, the complaint was made that the cores were unduly thick and the flesh coarse. Investigation has revealed that the "Long Tom" type originated as a bud sport on a plantation at Paterson's Siding, near Gympie, and that it was first introduced into the Mary Valley among other planting material in 1915. When the attention of growers was directed to its reputed superiority for canning purposes, there was an immediate demand for planting material. Suckers being difficult to obtain in quantity, most of the fields planted with the "Long Tom" type were propagated solely from slips. It is this strain which was subsequently found to be wholly unsatisfactory. In many respects it resembles the small diameter mutation, but differs from the latter in its slightly conical shape, its larger and flatter eyes and the development of protruding knobs on the shoulders of the fruit instead of at the base (Plate 15). This knobbiness is accentuated during wet summers, but is rarely evident during the winter months. In habit of growth, the "Long Tom" type is similar to the "collar-of-slips." Slips are produced freely, but suckering is poor. The plant is vigorous and erect and the fruit is very late in maturing. No record exists of the occurrence of this defective type outside of the Mary Valley. Where it occurs, it may be eradicated by selection in a manner similar to that suggested for the elimination of the small diameter mutation.

Dry and Bottle Neck Fruit.—These abnormal fruit types are different expressions of the same mutation. In the dry fruit the floral organs are entirely non-functional and the "fruit" structure consists essentially of overlapping swollen bracts attached to a non-edible core.

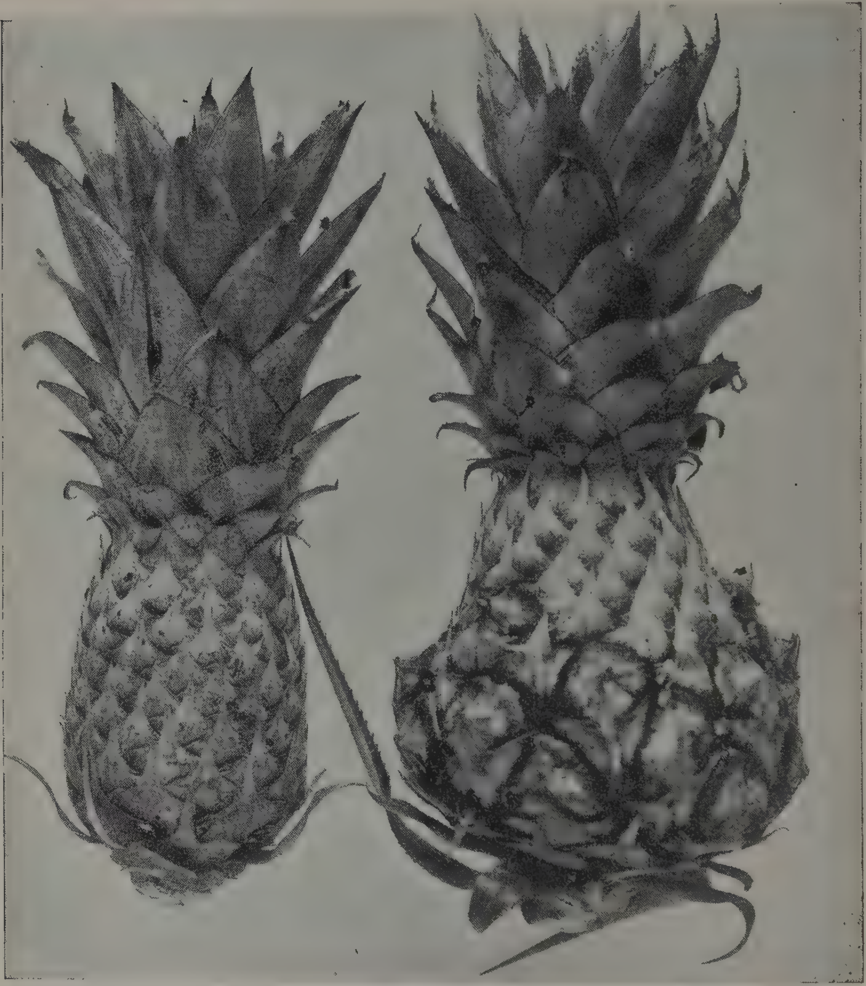

Plate 16.

DRY FRUIT ON THE LEFT: BOTTLE-NECK FRUIT ON THE RIGHT.

The bottle-neck differs from the dry fruit type only in that a varying number of normal florets are produced at the base of the flower spike and these develop into normal fruitlets (Plate 16). The contraction in the diameter of the fruit at the transition zone between normal and vestigial fruitlets produces the typical bottle-neck appearance, from which the abnormality derives its name. The mutation which gives rise to dry and bottle-necked fruit, is unstable and in its mildest form it may be expressed only as a pronounced neck between an otherwise normal fruit and its crown. Dry and bottle-necked fruits are sub-normal in size; the former are invariably worthless and the latter generally so. They are usually produced on plants which are dwarfed and stunted in habit. The condition is always hereditary (Plate 17) and may be eliminated entirely by uprooting all plants which exhibit the tendency.

Plate 17.

DEMONSTRATION OF THE INHERITABILITY OF THE DRY FRUIT AND BOTTLE-NECK MUTATION.—Descendants of a single plant which exhibited the bottle-neck character three generations previously.

"Cannon Ball" Type of Fruit.—This is considered to be a variant of the bottle-neck type of mutation in which the diameter of the fruit is equal to or in excess of its length. The fruitlets which develop normally, though relatively few in number, are much enlarged, while the vestigial ones above them are small and inconspicuous and do not form a neck to the crown. In consequence, the fruit is round or elliptical in shape and is usually undersized (Plate 18). It is worthless for canning, and has little other marketable value.

"Crippled" Fruit.—In an hereditary form this type of fruit abnormality is known to occur only in the Queen variety. As the name implies, the fruit is misshapen and distorted and is usually undersized (Plate 19). The distortion arises from the failure of certain fruitlets to develop normally. Those which do develop exhibit considerable irregularity in shape and size; some of them are both greatly enlarged and abnormally flattened for this variety. A dark-coloured corky streak,

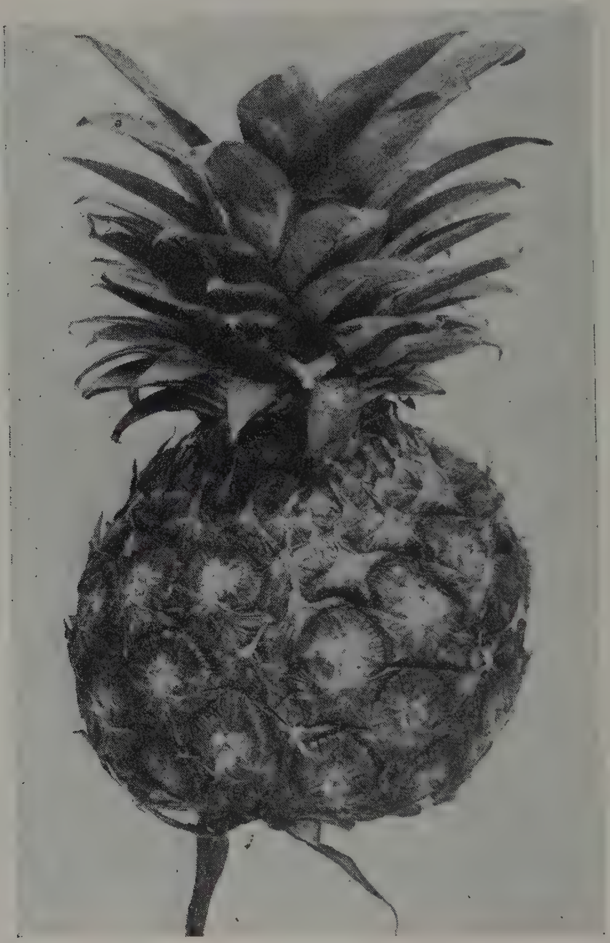

Plate 18.
"CANNON BALL" TYPE OF FRUIT (cf. Plate 16).

about one-eighth of an inch in width, develops medially along the under-surface of the lower leaves of plants or suckers which produce crippled fruit. This character provides an easy and certain means of identifying such plants, even when they are not in bearing. As crippled fruits are worthless, plants which produce them should be uprooted on sight in order to avoid any possibility of their being used as sources of planting material.

The "Prickly-eyed" or "Christmas" Type of Smooth Cayenne Fruit.—As the first name implies, this type is characterised by sharply protruding eyes (Plate 20), in which respect it resembles the Queen variety much more than it does the normal type of Smooth Cayenne. It is not hereditary, however; as mentioned in Chapter II, it is the type of Smooth Cayenne fruit which matures in south-eastern Queensland during December and the early part of January, and it is regarded as the normal type for that period. Reference is again made to it here because it is an exception to the rule that extreme variations are generally hereditary in character. A mutation from the Smooth Cayenne which possesses fruit characteristics somewhat similar to those exhibited by "Christmas" pineapples in Queensland has been reported from Hawaii, where it is known as the "Rough Eye." This hereditary type is not known to occur locally.

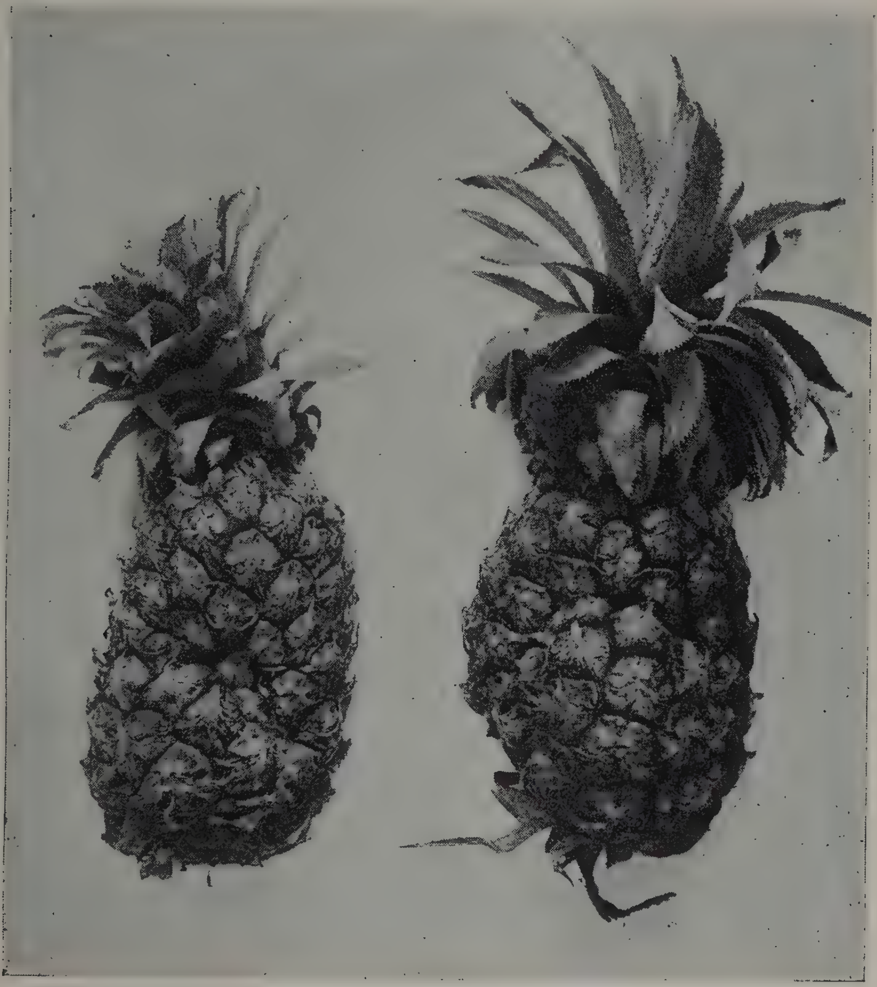

Plate 19.

"CRIPPLED" FRUITS OF THE QUEEN VARIETY.

Selection of Superior Strains.

A pineapple variety can be maintained true to type only through the persistent and systematic elimination of all variations which arise as bud sports. While most of the variations which attract notice are objectionable, a few may display growth or fruiting characters which are superior to the normal. If these desirable characters are inherent in the plants which exhibit them and are not due merely to the influence of a favourable environment, they will be reproduced in the progeny of these plants in the same way as those of an objectionable type. Thus, by propagating only from plants which exhibit desired characters, it is possible to effect an all-round improvement in the quality and yield of the fruit harvested. If one plant only is selected and this is multiplied by suitable methods of propagation, the result will be a new variety or strain, depending on the degree to which it differs from a normal varietal type. Propagation in this way of new varieties or varietal strains from a single plant is known as *clonal selection*, since all of the plants which stem from one individual are said to constitute a clone. Except for minor differences arising from environmental influences, all of the plants

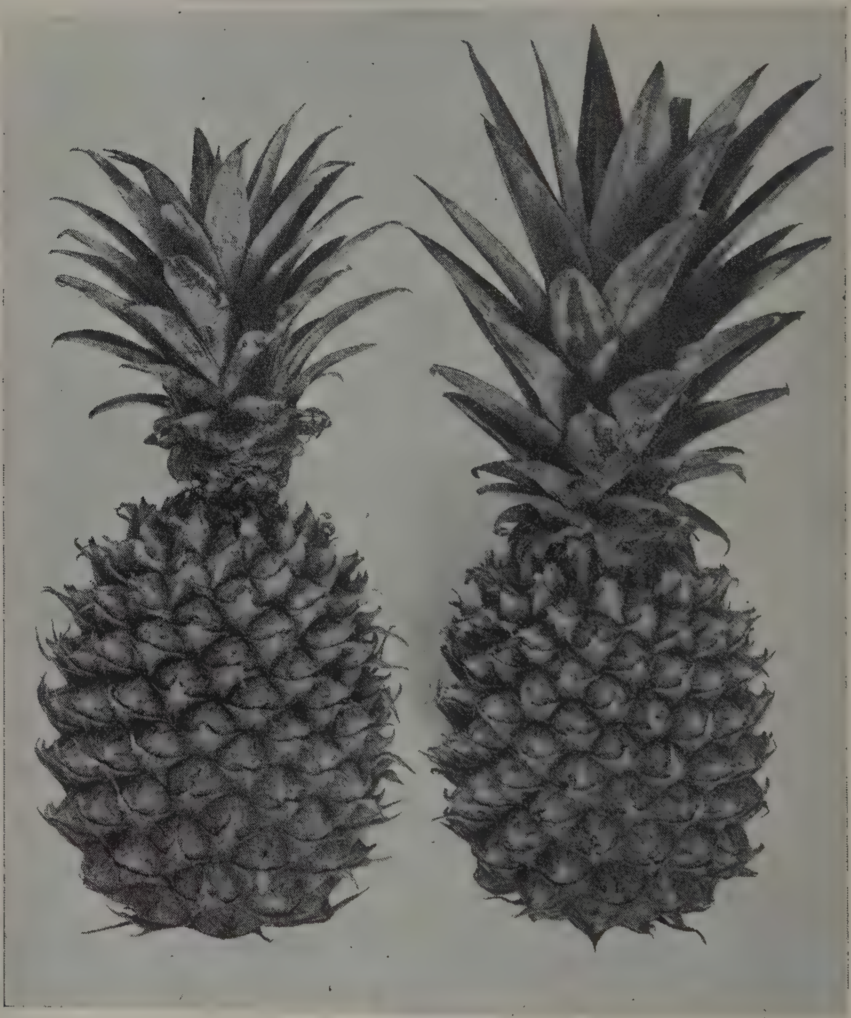

Plate 20.

"PRICKLY-EYED" OR "CHRISTMAS" TYPE OF SMOOTH CAYENNE FRUITS (non-hereditary).

belonging to a clone are alike (Plate 21). Ordinarily, the plant population of a pineapple plantation is made up of a large number of clones, but the differences which exist between many of these are imperceptibly small. Consequently, in one field numbers of inherently different plants may display similar characters. If these characters are of a desirable type their occurrence in succeeding plantings may be intensified by propagating only from plants which exhibit them. This is known as *mass selection*. While clonal and mass selection are both of great value in effecting improvements in pineapple varieties the former is employed chiefly for developing new strains and the latter for raising the level of productivity of existing strains.

Plate 21.

A CLONE OF SIX PLANTS OF A DESIRABLE TYPE OF SMOOTH CAYENNE, ALL OF WHICH WERE PROPAGATED FROM A SINGLE PARENT.—Note the high degree of uniformity displayed.

Methodically carried out, mass selection leads to a rapid improvement in plant type, fruit quality and yield. "Collar-of-slips" and other objectionable types are automatically eliminated and, by raising the general level of vigour of a plantation, losses from diseases are reduced. In many Queensland plantations, the depression in yield which results from the cultivation of defective types probably exceeds the losses caused by diseases and pests of all kinds. The latter usually attract more attention simply because they are more conspicuous.

Time of the Year and Stage of Plant Development at which Selection should be Carried Out.—Before considering the plant and fruit characters on which selection is based, attention must again be drawn to the fact that environmental influences exert a profound effect not only on vigour of growth, but also on type of growth. The size and shape of the fruit, the type of crown, the number of suckers and slips which are produced, and the stage of development which they may have attained when the fruit matures—all these characters, as well as others, differ in degree of expression according to the conditions under which a plant is grown. In south-eastern Queensland, fruit size tends to increase during the winter months, but the growth of suckers is greatly retarded and the development of slips is generally entirely suppressed (Plate 22). Opposite tendencies are apparent during the summer months (Plate 23). The reasons why these seasonal differences occur have already been discussed (Chapter II). The fact that they do occur has an important bearing on plant selection work in that it limits the period during which such work may be successfully carried out. In a plant of the Smooth Cayenne variety, the degree to which the tendency to produce slips is inherent and the manner in which this tendency may be expressed are all-important considerations in determining its economic worth. Consequently, selection in this variety is of value only if it is

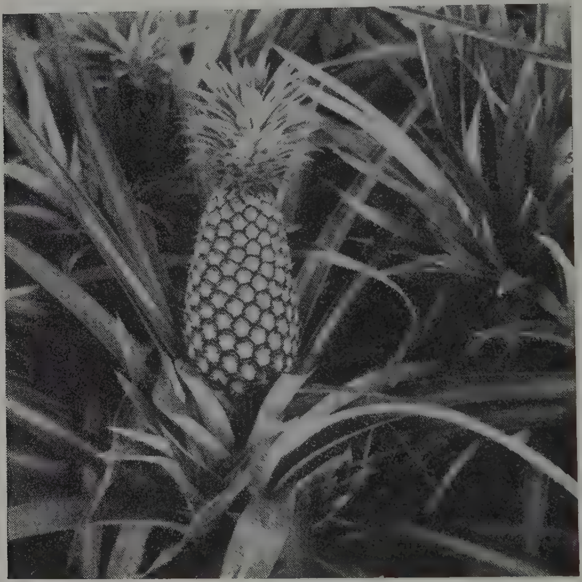

Plate 22.

WINTER TYPE OF SMOOTH CAYENNE (SOUTH-EASTERN QUEENSLAND.)—With upper leaves cut away to show extent to which growth of suckers has been retarded by unfavourable climatic conditions. Note conical shape of the fruit, which is characteristic for this time of the year.

carried out at the time of the year and at the stage of plant development at which the slipping tendency is most evident. For all practical purposes, therefore, this restricts the practice of both mass and clonal selection to plant crop fields which mature during the summer months.

Climate as a Factor in Plant Selection.—Because environmental conditions influence the degree of expression of the inherent characters of the pineapple plant, it follows that a variety or strain which has proved highly productive under the climatic conditions existing in one locality is not necessarily adapted to another in which different conditions obtain, even though these may be only a few miles apart. Consequently, the full benefits which are to be gained from plant selection are usually obtained only when it is carried out in the district in which the selected planting material is to be propagated. In other words, it is necessary to select in accordance with local climatic conditions.

Plate 23.

SUMMER TYPE OF SMOOTH CAYENNE (SOUTH-EASTERN QUEENSLAND).—Note strongly developed suckers and large crown on fruit, reflecting conditions favourable for vigorous growth.

Characters which should be Considered in Practising Selection.—These include: (1) Vigour and habit of growth; (2) suckering and slipping tendencies; (3) fruit characters; (4) uniformity of type; (5) aparent resistance to diseases.

Different plantations may exhibit varying degrees of vigour, according to the conditions under which they have been grown. The differetences which are important in selection work, however, are those which exist between neighbouring plants in the same field. As previously pointed out, vigour in itself is not a criterion of superiority, since some of the most objectionable plant types are vigorous growers. The length of the stem, the type of leaf, the numbers of suckers and slips produced and their position on the parent stem, are all factors which must be taken into account in assessing the vegetative characteristics of a plant. These and other points bearing on the choice of both plant and fruit characters have already been discussed in Chapter II. For the sake of emphasis, however, attention may again be directed towards the necessity for selecting only from plants in which all of the slips are attached low down on the fruit stalk (Plate 24).

The same discrimination should be exercised with regard to fruit characters as is made with respect to vegetative ones. The size and relative weight of the fruit, its shape, the degree of prominence displayed by the eyes, the nature of the crown and the length of the fruit stalk are all points which should be taken into consideration in selecting improved types. The texture, colour, and flavour of the flesh are also important characters, but it is impracticable to determine these without sacrificing the fruit. In mass selection, uniformity of type is a desired quality, particularly with respect to the period at which the fruit matures. Apart from this, late maturing plants often possess objectionable tendencies and should be rejected whatever other attributes they may exhibit. Finally, only disease-free plants should receive consideration in carrying out a selection programme, more especially in fields in which wilt or other diseases occur.

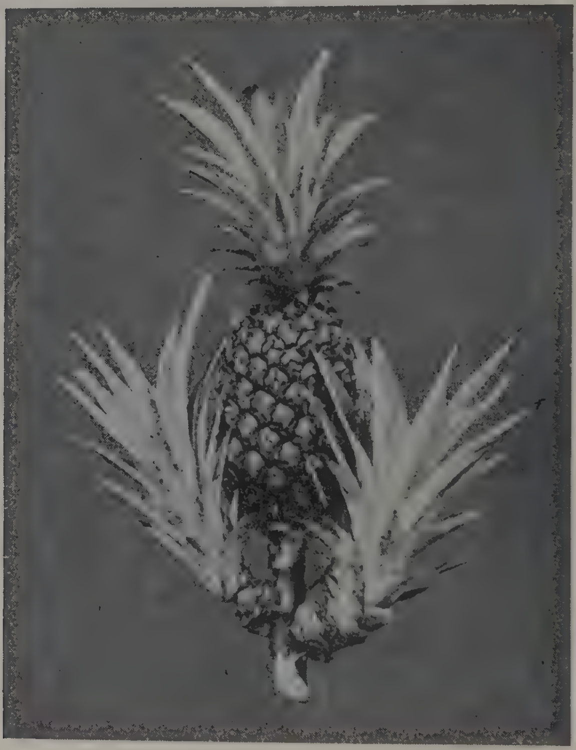

Plate 24.

SLIPS DESIRABLY PLACED ON THE FRUIT STALK.

Practical Mass Selection Methods.—Of the various mass selection methods which have been devised, two have been shown to be eminently practicable under Queensland conditions. The first of these is an arbitrary one based on the number and position of the slips on the parent stem. Consequently, its application is confined to plant crop fields which come to maturity during the summer months. Essentially, the method consists in rejecting as sources of planting material all plants which bear more than three slips, or, in fields which contain a high proportion of "collar-of-slips" plants, all those which bear more than two. Of equal importance to the number of slips is their placement on the fruit stalk. Those springing close to the base of the fruit should be rigorously rejected, as in this position they may arise from a plant with an inhibited "collar" tendency. While the slips themselves may remain on the parent plants until several weeks after the plant crop has been harvested, the actual selection should be carried out just as the fruit is approaching maturity. At this time, those plants which it is desired to use as sources of planting material should be marked by daubing one or two of their outside leaves with white paint. The crowns may also be marked at this time if there is a likelihood that the fruit will be marketed for canning purposes. When the slips and crowns from the marked plants are gathered they should be segregated from all other planting material collected during that season so that they may be planted separately. About fifteen months later, however, before the plant crop of this selected stock is harvested, the plants should be examined individually and any showing abnormalities, such as "collar-of-slips," or those lacking in suckers or slips, or exhibiting a high-stemmed or weak, stunted type of growth, or any affected with wilt should be given a distinguishing paint mark. These marked plants should be left intact until after the planting material has been gathered from the field. This selected planting material should again be planted separately from that obtained from other parts of the plantation and, in due course, the plants which have developed from it should be reselected as before. If sufficient planting material is selected initially to plant up half an acre it will provide stock from which three times that area may be planted in the next generation.

A second practical method of selection for improving plant type and yield combines the principles underlying both clonal and mass selection. This method is genetically sounder than the one which has already been described, but it is somewhat slower and more time-consuming in its initial stages. It consists essentially in segregating the progeny of especially desirable plants as distinct clones during the first generation only, after which mass selection is resorted to for maintaining the improvement which has been gained. Individuals exhibiting characters superior to those displayed by the general run of plants in a field and also a high degree of uniformity among themselves are distinctively marked at the time the first crop approaches maturity. Subsequently, the propagating material obtained from each of these plants—that is, slips, crown, and all suckers except one—is planted together in clones. Planting must be carried out in such a way that there is no possibility of the plants in different clones becoming mixed should any of them die out. In double-row beds, this may be effected without the use of stakes or other markers simply by staggering alternate clones about 6 inches from the line of the row. Just prior to the harvesting of the plant crop the clones are carefully examined and their characteristics compared. Any which are inferior or in which an abnormal tendency has become apparent are suitably marked so that they will not be used further as sources of planting material. The slips and such other shoots as may be available from the remaining clones are then harvested together as mass selected planting material. This is planted separately from the ordinary field run of planting material and provides a nucleus of improved stock from which further plantings may be propagated. For the complete success of this method it is essential that the identity of the selected stock should be preserved in each successive generation by keeping it segregated from non-selected planting material. In this method, it rarely happens that more than 20 per cent. of the clones originally selected are rejected at the time reselection is carried out. Consequently, if an original selection of 100 clones is made, each averaging five pieces of planting material, approximately 400 shoots would be available for further propagation after the undesirable clones have been eliminated. Within a period of four or five years, these would provide sufficient planting material to meet all of the requirements of the average plantation.

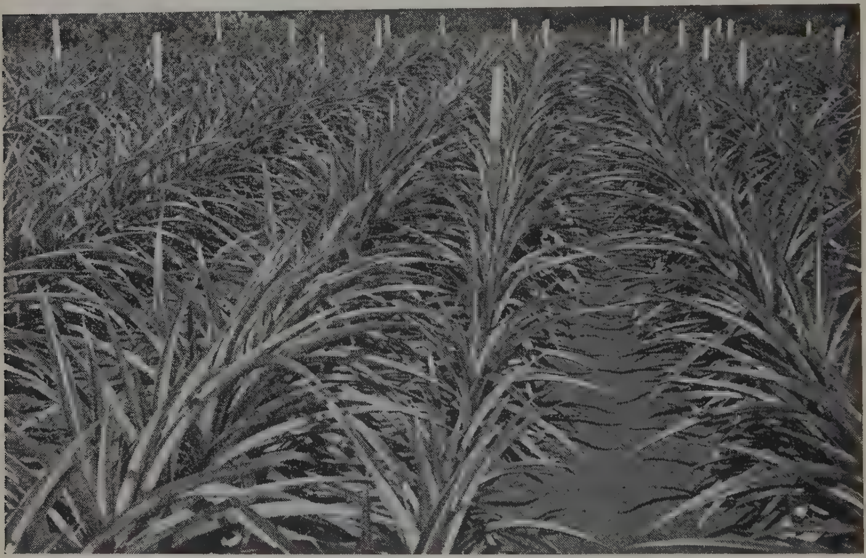

Plate 25.

CLONAL SELECTION IN THE SMOOTH CAYENNE VARIETY: IN EACH ROW, ALL PLANTS BETWEEN STAKES ARE DESCENDANTS OF A SINGLE PARENT, I.E., A CLONE.—Note the difference in size and vigour between the two clones in the foreground, although the plants within each clone exhibit a considerable degree of uniformity.

As the names implies, mass selection involves the propagation of planting material of mixed origin in contrast to clonal selection which is concerned only with the lineal descendants of a single plant. For this reason, an improvement which has been gained by mass selection can be maintained only by repeating the selection in each successive generation. If this is not done, there is likely to be a gradual reversion to the level of production which obtained before the first selection was made.

Clonal Selection.—While mass selection affords a practical and easily applied method of raising the productivity of commercial plantings, clonal selection—or, as it is frequently termed, *bud selection*—is employed chiefly as a means of developing new varieties or strains. In clonal selection, the planting material obtained from each plant is pooled with that collected from other plants of the same clone through successive generations until the variety or strain represented by the clone has been multiplied to the extent when it may be exploited commercially (Plate 25).

SPECIAL METHODS FOR THE EXPANSION OF NEW STRAINS OR VARIETIES.

The rate at which a new variety or strain can be propagated depends on the number of shoots which it produces. Normally, an average of five shoots of all kinds may be taken from an individual plant of a desirable type up to the time the first fruit matures, i.e., the plant crop. Starting with a single plant, it would take approximately ten years to obtain sufficient planting material of a new variety to plant up one acre if, in each succeeding generation, propagation was restricted to shoots collected at the plant crop. Obviously, speedier methods of building up a new strain or variety are desirable once its superiority has been established. Several ways of accomplishing this have been devised. Basically, all of these consist in forcing into growth a number of the dormant shoot-forming buds on the parent stem, thereby increasing the number of shoots which will be available for propagation purposes.

The simplest way in which this may be accomplished is to remove all offshoots from the plant stem as soon as they are large enough to root when planted out under field conditions. Provided the parent plant is in a vigorous state of growth, other axillary buds will then develop to produce a fresh crop of suckers. When these are large enough to plant they are also removed and the process is repeated as long as new shoots can be induced to develop.

The successful exploitation of this method depends, of course, on maintaining a high growth rate in the parent plant. To achieve this adequate fertilizing is essential and where irrigation is practicable it also may be employed to great advantage, provided it is carried out judiciously.

The Stump Section Method.—A more effective but slower method of forcing dormant buds to develop into shoots which may be used for propagating purposes is to cut the parent stem into small pieces and plant these under suitable conditions of warmth and moisture. This is known as the stump section method. It was devised several years ago in the West Indies, but several modifications have been made in the method which was then described. The procedure which has been found most satisfactory for Queensland conditions is, briefly, as follows:—

Some time after the fruit has been harvested, i.e., when the starch content of the stems is high, the plants which have been selected for sectioning are removed from the field and stripped of their leaves. (Plate 26). The stem which remains is thoroughly washed and laid

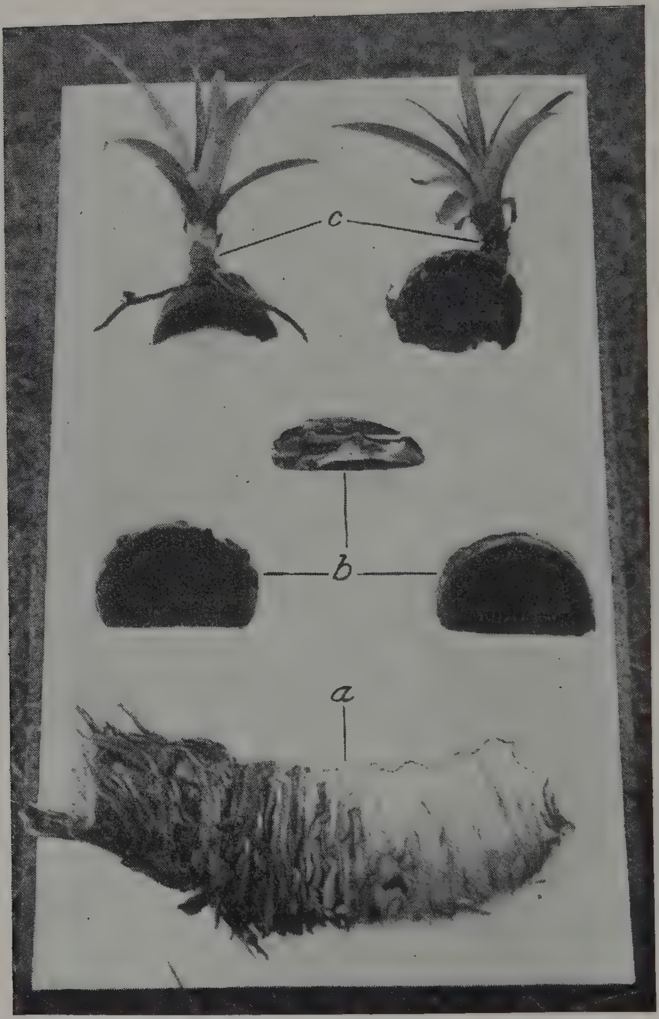

Plate 26.

THE STUMP SECTION METHOD OF PROPAGATION.—(*a*) Stump stripped of its leaves. (*b*) Sections after dipping in potassium permanganate solution. (*c*) Plantlets two months old.

aside in the shade for several days to "cure." It is then cut into wedge-shaped sections about ½ in. thick at their widest part: each of these will have several dormant buds on its outer surface. The sections are surface-sterilized by soaking them in a 5 per cent. solution of potassium permanganate for ten minutes. When they have been thoroughly drained they are planted vertically in hardwood boxes containing rich, friable soil underlying a layer of sawdust. The sections are pushed into the sawdust until they just touch the soil underneath. In the cooler months, the boxes are placed on hot beds covered by protective calico shades, but during midsummer, bottom heat may be dispensed with. Within a month from the time of planting the shoots which develop from the sections begin to produce their own roots. From one to three shoots usually develop from a section, though all sections may not produce shoots. Those cut from the middle part of a stump generally prove most satisfactory. After three months or so the sections are lifted and divided according to the number of plantlets which have developed from them. These are transplanted into larger flats which are then transferred to a lath house (Plate 27). Nine or ten months later the plants are set out in the field. Plants which have been raised in this way usually take about the same time to come to maturity as seedlings, that is, approximately three years.

By employing the section method of propagation about twenty-five plants can be propagated from each stem. Also available for planting are all of the various shoots which are normally produced on the parent plant while the fruit is developing. In comparison with ordinary methods of propagation, therefore, the stump section method enables the rate of expansion of a new variety or desirable type to be accelerated six-fold, but the employment of this method is rarely practicable after the second generation, owing to the work entailed and the equipment required. Nevertheless, its use during this period reduces by half the time which would otherwise be required to establish a new variety or strain in commercial production.

Plate 27.

YEAR-OLD PLANTS PROPAGATED BY THE STUMP SECTION METHOD.—Each box contains the progeny of a single stump. At this stage the plants are ready for setting out in the field.

Still another method of obtaining an increased rate of propagation in the pineapple has recently been suggested by Macluskie in Sierra Leone. This method is really a modification of the stump section method, from which it differs chiefly in the manner in which the stems are sectioned. Instead of cutting them transversely into $\frac{1}{2}$-inch sections, they are quartered longitudinally. The inner surfaces of the slices are then pared flat, after which they are planted in a nursery bed, rich in organic matter, by pressing them halfway into the soil. Four to eight weeks after planting the slices are lifted and the plantlets which have developed are sectioned off and transplanted to another nursery bed for further growth before being planted out in the field.

Under Sierra Leone conditions, the Queen variety is said to produce an average of seventeen plants per stem by this method, while the Smooth Cayenne gives an average of only five. Since it is claimed that the stage of stem development at which best results are obtained is that which is reached when the plant is fully grown and just about to flower, i.e., before suckers or slips have begun to develop from it, the method would not appear to possess any advantage over ordinary propagation practice as far as the Smooth Cayenne variety is concerned.

In addition to their value for building up new or improved varieties the special methods which have been described are also employed for propagating varieties which have been imported from other countries. By their use, it is possible to confine importations of a desired variety to a few plants only, thus minimising the risk of introducing new diseases or pests and yet enabling it to be established commercially within a reasonable space of time.

(TO BE CONTINUED.)

FEED TROUGH ON SKIDS.

This portable feed trough, designed by the United States Department of Agriculture, is portable, since it is mounted on 4 x 4 runners. It is 14 feet long. The upright supports are 6 feet apart and are 4 x 4, while all the braces are of 2 x 4.

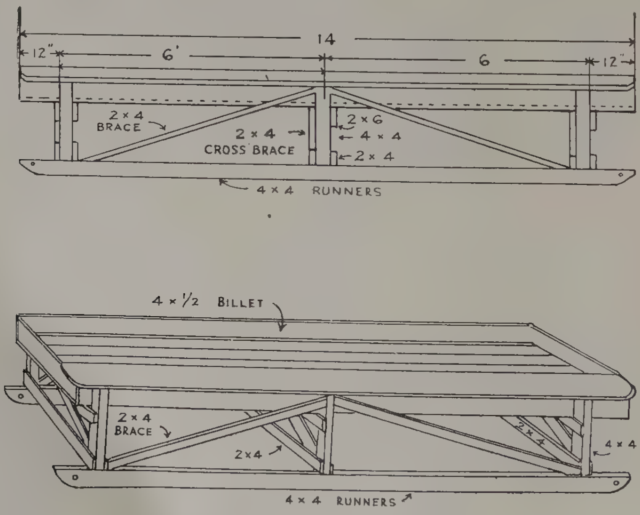

Plate 28.

The crosspieces which support the floor of the rack are 2 x 6, and so are the flanges. The corners are rounded to prevent injury to the stock. The rack can be pulled around to wherever it is needed.

Fused Needle Disease and its Relation to the Nutrition of Pinus.

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CONTENTS.

SUMMARY.

PART A.—GENERAL INVESTIGATIONS BEARING ON FUSED NEEDLE CONTROL.

I. Introduction.
II. Description of the Disease, and its Importance.
    Distribution of Fused Needle Disease.
    Symptoms of Fused Needle Disease in Australia.
    Susceptible Species.
    The Economic Importance of the Disease.
        (*a*) The Effect on the Individual Tree.
        (*b*) The Incidence of the Disease in Queensland.
        (*c*) Progressive Development with Age of the Plantation.
III. Preliminary Investigations into the Cause of the Fused Needle Condition.
    The Virus Hypothesis in Relation to Fused Needle Disease.
        (*a*) Mechanical Inoculations.
        (*b*) Serological Tests.
        (*c*) Grafting Experiments.
        (*d*) Search for Insect Vectors.
        (*e*) Conclusion.
    Climatic Factors in Relation to Fused Needle Disease.
    Genetic Factors in Relation to Fused Needle Disease.
    Mechanical Factors in Relation to Fused Needle Disease.
IV. Investigation of Soil Factors in Relation to Fused Needle Disease.
    Physical Condition of the Soil.
    Soil Deficiency in Major Elements.
    Soil Deficiency in Minor Elements.
    Soil Organic Matter.
        (*a*) Pot Experiments.
        (*b*) Transplanting Experiment.
        (*c*) Soil Treatment in the Field.
        (*d*) Delayed Planting.
V. Soil-manuring Experiments, with Special Reference to Phosphate Status.
        (*a*) Broadcast Dressings.
        (*b*) Total Phosphate Requirements.
        (*c*) Conclusion.
VI. The Practical Application of the Results of the Investigations.

PART B.—THE MYCORHIZAL THEORY REGARDING THE CAUSE OF FUSED NEEDLE DISEASE.

I. Introduction.
II. The Morphology and Distribution of Mycorhizas.
III. The Physiological Rôle of Mycorhizas.
IV. The Condition of the Mycorhizas of *Pinus* in Queensland.
    The Characteristics of Mycorhizas on Fused Needle Sites.
    The Form of Mycorhizas under Various Soil Treatments.

V. A Carbohydrate Hypothesis for the Significance of Mycorhizas and the Cause of Fused Needle Disease.
    Discussion of Physiological Basis.
    The Significance of Carbohydrate Assimilation in Mycotrophy and its Application in Connexion with Fused Needle Disease.
    Experimental Evidence Bearing on the Carbohydrate Hypothesis.
        (*a*) Carbohydrate Treatment Experiments.
        (*b*) Pruning Experiment.
        (*c*) The Effect of Different Species of Mycorhiza-forming Fungi.
        (*d*) Summer Fluctuation in Percentage of Needle Fusion.
    The Relationship between Phosphate Status and the Carbohydrate Hypothesis.
VI. General Conclusion.
VII. Bibliography.

SUMMARY.

THE distribution of fused needle disease of *Pinus* in Australia and other countries, together with the various symptoms connected with the trouble and the species of *Pinus* affected, are discussed. The typical fused needle condition is thought to be only one of a number of closely-related abnormalities.

The economic importance of the disease, as affecting coniferous plantations, is considered. It appears that the trouble is a limiting factor in the establishment of exotic pines in certain localities.

Experiments showed that all factors, save soil, have no direct influence on the condition. Genetic factors are thought to act in a secondary manner. In connection with soil factors, it is considered that minor elements and the physical nature of the soil can be dismissed as primary causes. The action of phosphorus in relation to pine nutrition is found to be of major importance.

The organic matter complex appears to be fundamentally related to the occurrence of the trouble, and a number of experimental observations concerning this are described and discussed.

Success in the control of fused needle and related abnormalities by the use of phosphatic manures was obtained in a number of field experiments. The theoretical background of this work is discussed and the experiments described. It is thought that the fertilizers act chiefly in a secondary manner by stimulating the production of organic matter and by aiding the development of a satisfactory mycorhizal complex.

The practical application of fertilizer treatment in general plantation practice is described and discussed.

The development of the knowledge of mycotrophy is briefly reviewed, and a general mycorhizal theory to explain the cause of fused needle disease is advanced.

Normal and abnormal mycorhiza are discussed in relation to the occurrence of fused needle disease and related conditions. The unsatisfactory mycorhizal condition is associated, in the case of the majority of fused needle sites, with a low total phosphate value in the soil. The relative absence of surface litter formation is considered to be due to this deficiency. The lack of raw organic matter possessing a relatively high phosphate content is thought to be conducive to the development of faulty mycorhizal systems, with resultant abnormal growth in the trees.

A carbohydrate hypothesis for the physiologic rôle of tree mycorhizas is propounded as an adjunct to the nitrogen-mineral salt theory, and experiments supporting this contention are described. According to this hypothesis, normal mycorhizas supply the tree with an essential part of their carbohydrate supply, and it is to the inefficient functioning of the mycorhizas in this respect that the fused needle condition is due. The supply of additional phosphorus to soils low in this element results in a more abundant phosphatide excretion from the pine roots, thus stimulating normal mycorhiza formation and bringing about a satisfactory balance of conditions for correct mycotrophic activity. The amount of vegetable detritus present is important in this respect, as it is from this source that the carbohydrate supplied to the higher plant by the mycorhizal fungus is obtained. The addition of phosphates to the soils in question stimulates the growth of natural vegetation, and thus aids the development of the necessary supply of vegetable detritus.

PART A.—GENERAL INVESTIGATIONS BEARING ON FUSED NEEDLE CONTROL.

I.—INTRODUCTION.

During the period which has elapsed since the issuing of the first report dealing with investigations into the fused needle disease of *Pinus* in Queensland (Young, 1935) a considerable amount of progress has been made, and at the present time it has been proved that corrective methods, devised during the experimental work, are economically applicable to routine plantation operations with satisfactory results. The investigations on which these results are based had, as their foundation, a hypothesis first suggested in 1934, which presupposes that the mycorhizal complex of the affected trees is in some way connected with the diseased condition. The present paper has been prepared in order to set out the results of the investigations which led to the practical solution of the problem, together with a discussion of the theory underlying the work. A brief rèsumè of the contents of the earlier report has been included in this paper for the sake of clarifying the position leading up to the investigations described.

II.—DESCRIPTION OF THE DISEASE AND ITS IMPORTANCE.

Distribution of Fused Needle Disease.

In Australia, fused needle disease is present in all States of the Commonwealth on many soil types, but has only been considered of importance in Tasmania, New South Wales, and Queensland. The first published reference to it appeared when Samuel (1922) discussed this trouble in relation to its appearance in South Australia. Later in the same year Birmingham (1922) considered the subject with reference to New South Wales. Descriptions and discussions of the disease as it occurs in Western Australia have been published by Kessell and Stoate (1936, 1938). Investigations into the cause of the fused needle condition were commenced in Queensland in 1933, and have been carried on by the writer, along with other aspects of forest pathology, since 1934.

Records of the occurrence of the disease outside Australia have been made in *Pinus radiata* in England (Rayner, 1938; and Jones, 1938), in California at the Institute of Forest Genetics and in plantations of *Pinus radiata* at San Bernardino (Rodger, 1931), in South Africa (Sherry, 1938; and Ludbrook, 1939), and in New Zealand north of the kauri line. No records of the trouble have been made in the naturally occurring stands in the United States of America, which is the native habitat of the majority of species of exotic conifers of forest importance in Australia. One doubtful record of the occurrence of fused needle disease is a case of needle-twisting observed by Addoms (1937) in *Pinus tæda* used in nutritional studies in the Eastern United States. In this instance the abnormality was thought to be caused by the effects of low humidities, but an artificial increase in this factor made no difference to the occurrence of the condition. It is reported that the twisting was observed more frequently in the plant house than in the field.

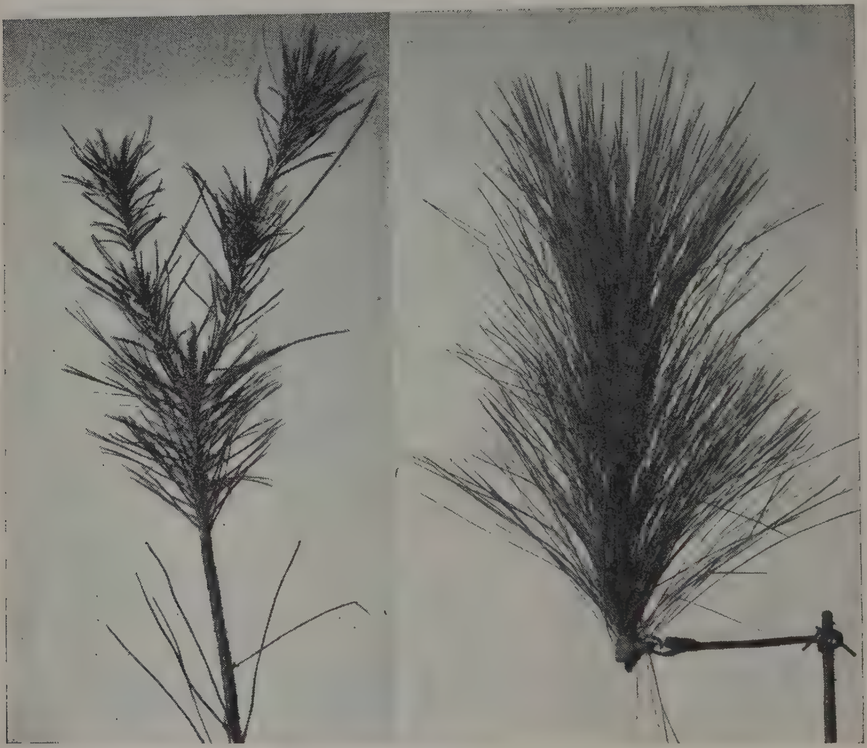

Plate 29.

FUSED NEEDLE SYMPTOMS IN PINUS CARIBÆA.—(Left) affected branch, showing suppression and resinosis of terminal bud; (right) healthy branch for comparison.

Symptoms of Fused Needle Disease in Australia.

The symptoms of the malady in Australia have been described by Samuel (1922), Birmingham (1922), Young (1935), Kessell and Stoate (1936, 1938), and Ludbrook (1937).

There appears to be some confusion as to the types of growth which may be included under the heading fused needle, needle fusion, or curly needle, and it is considered that, as a result of experience in Queensland and observations carried out in New South Wales, the definition of fused needle might be legitimately expanded to cover a number of other growth abnormalities.

The description of the disease given by Young (1935) and Ludbrook (1937) covers the symptoms exhibited by the trouble in its typical form. This is manifested by the stunting of the tree, accompanied by the twisting and adhesion of the needles of each fascicle. In *Pinus tæda* and *P. caribæa* a resinosis of the terminal buds often appears at the same time. This resinosis frequently occurs as a copious exudate, but more often gives the bud a hard, varnish-soaked appearance. The terminal bud is often suppressed by the mechanical action of the dried resin, and new buds develop below it, giving rise to a condition of multiple leaders. The same reaction is experienced by the branches. The fasciated type of branching thus produced frequently recurs, and, as a result, a very shrubby, stunted tree is produced.

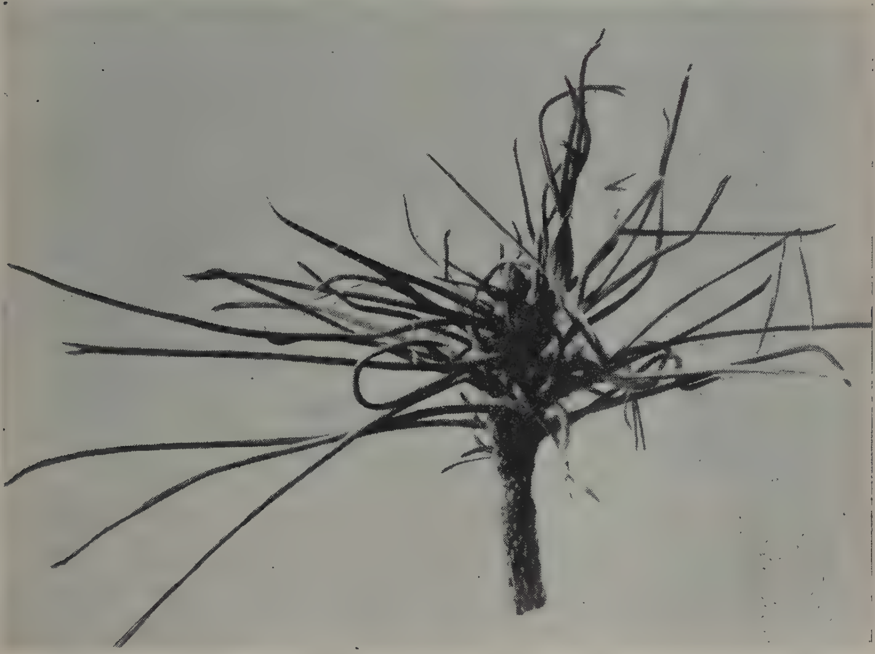

Plate 30.

TWIG OF PINUS CARIBÆA. Showing fused fascicles.

Observations in Queensland have shown that the needle fascicles on affected trees may develop normally as regards the emergence of the needles from the fascicle sheath, but these, later, may fail to separate. They are typically twined about each other. The contiguous surfaces adhere by means of a resinous film, and the union is often reinforced by the outgrowth of epidermal cells of one needle into the opposite stomata of its neighbour (Young, 1935). This outgrowth probably occurs as a result of pressure due to the constriction of the developing needles in the fascicle sheath. In bad cases the needles remain short and often become stouter, and, in very severe cases, scarcely emerge from the sheath. In lightly-affected cases the needles often do not adhere, but are loosely twisted about each other.

Another symptom often noted in connection with the disease is the appearance of "concertina" needles. When these occur, the fascicle has failed to open until very late, resulting in a bunching and concertina-like folding of the needles. This phenomenon is often present on trees which do not have any other indication of fused needle, but it has been observed on numerous occasions to precede the definite onset of fusion during the same or the following growing season. In other cases, however, the trees have behaved normally. This appearance is common in *Pinus caribæa,* and also occurs in *P. palustris.* The shedding of a large proportion of the needles only one year old is common in all the forms noted.

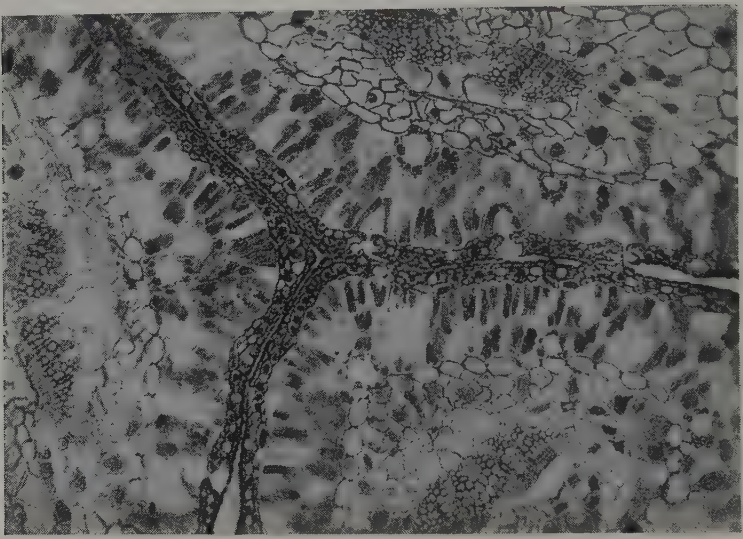

Plate 31.

FUSED FASCICLE OF PINUS CARIBÆA. Section showing outgrowth into the stomata of the opposite needle. (× 70.)

The production of small and usually infertile but persistent cones is also a characteristic of many badly fused trees.

Microscopically, the needles of fused trees exhibit an absence of starch granules, whilst in healthy trees the starch is usually abundant. Ludbrook (1937) states that the phloem of the stem and branches of severely affected trees often exhibits a light-brown discolouration. In Queensland, however, numerous sections cut from diseased tissue of *Pinus tæda* and *P. caribæa* have failed to demonstrate the presence of this abnormality.

In the majority of cases examined, mycorhizal roots of fused-needle-affected trees exhibit an abnormal darkening in colour and, for the most part, are thin and of the simple type. Microscopic studies with these roots show an unbalanced association in which the mycorhizal fungus has developed a parasitic habit with the formation of intracellular haustoria—that is, a pseudo-mycorhizal condition is present. There is also a disproportionally large number of dead as compared with functional mycorhizas on trees in affected situations; considerable numbers of what appear superficially to be normal coralloid mycorhizas are present, but a microscopic examination of these usually demonstrates the presence of a diseased condition. This is evidenced by the almost total obliteration of the cortical cell structure of the rootlets by fungal growth, which occurs as a toruloid mass. The mantle is, in these cases, often only two or three cells thick.

These mycorhizal characters are, from the writer's observations, of general occurrence in unhealthy, poorly-developed stands of *Pinus* spp. in New South Wales and Queensland even when actual needle fusion is absent. This fact, together with other evidence, has led to the conclusion that this lack of vigour and general poverty may be related in its origin to the more typical condition known as fused needle.

In plantations at Beerwah where clean chipping of the soil surface has been carried out in connexion with experiments with fused needle disease it has been noted that both a yellowing and thinning of the crown and some rosetting have occurred on these plots, and not on the unchipped controls, whilst fused needle proper has also been accentuated by the treatment, as will be seen when the experiments are discussed later. The development of one form into another—such as thin crown and yellowing into fused needle, and rosetting into fused needle—together with the apparent inherent variability of various individuals of any one species as regards fused needle susceptibility, has led to the conclusion that these abnormal conditions cannot each be placed in different categories, and that they are all symptoms of the same cause. It is considered that these forms can legitimately and conveniently be classified as types of fused needle. Some of the abnormalities are briefly discussed here.

A condition which is evidenced by the shortening of the needles of plantation trees of from two years of age upwards, which is usually accompanied by the shedding of a large proportion of the needles of the previous year, and often of needles of the current year, is frequently observed. A similar abnormality has been noted by Kessell and Stoate (1938), in Western Australia, and is known to them as "rosetting." The affected trees are dwarfed in habit. The symptoms are of more frequent occurrence in *Pinus radiata* than in *P. tæda* and *P. caribæa*, though in the latter it is not uncommon on bad sites. The condition in Queensland occurs most frequently on sites subject to fused needle disease, and in some instances, trees affected in this manner (*P. tæda* and *P. caribæa*) have been noted to develop later the typical symptoms and often possess twisted, if not fused, needles. In the case of *P. tæda* and *P. caribæa*, which are the principal species cultivated in Queensland, the proportion of "rosetting" to fusion, as calculated from observation plots, is as 1: 9 in the case of *P. caribæa* and 1:11 in *P. tæda*. In *Pinus radiata* at Pechey typical needle fusion is rare, though rosetting and other abnormalities are frequent. This state of affairs was also noted in Southern New South Wales.

Another abnormality of frequent occurrence, the incidence of which appears to be related to that of fused needle proper, is a thin-crowned appearance. In this case, as the term indicates, there is a more or less scanty development of needles on the affected trees, and a good canopy is not formed. Even on sites very badly affected with fused needle disease, one condition has not been observed to develop into the other. Trees showing thin crown are usually of a spindly, lightly branched form and exhibit a great reduction in growth. The abnormality has been described under the name "thin crown" by Kessell and Stoate (1938), in *Pinus radiata* in Western Australia, and has been observed in that species in Queensland and New South Wales. A similar condition is frequently seen in *P. tæda* on fused-needle-affected areas at Beerwah. The condition has rarely been noted in *P. caribæa.*

In some cases a chlorotic condition occurs which appears to be associated with thin crown. This condition—"yellowing"—was described by Kessell and Stoate (1938). It has commonly been noted in Queensland in *Pinus tæda* and *P. caribæa* on sites subject to severe fused needle, and is assumed to be the same as that described from

Plate 32.
"THIN CROWN" TYPE OF FUSED NEEDLE DISEASE IN PLANTATION AT BEERWAH (*Pinus tæda*).

Western Australia. The appearance of the trees affected is distinct from the chlorotic colouring due to bad drainage, the latter condition showing a general yellow appearance without reduction in foliage. Most of the "yellowing" trees appear to suffer from thin crown in some degree, and in Queensland the two conditions appear to grade into one another. Kessell and Stoate (1938) have noted an improvement in thin-crown trees between the tenth and fifteenth years. This improvement accords well with the similar experience in fused-needle-affected trees and the litter and mycorhizal theory propounded later in this paper.

The occurrence of fused needle, rosetting, thin crown, and yellowing on the same sites and their apparent interrelationship indicated that the abnormalities named might be closely related in their respective causes. This is also borne out by the response of trees possessing any one of the types of abnormality referred to to treatment with phosphatic fertilizers. Microscopic examinations of mycorhizas of trees affected with all the various abnormalities from New South Wales and Queensland have presented similar pictures.

From the point of view taken here, it is considered that an investigation into fused needle disease is really an investigation into the causes of the unsatisfactory growth of *Pinus*. From a consideration of the literature and observations by the writer, this poor growth is, on the whole, more in evidence in some of the other States than in Queensland. Contrary to the view expressed by Ludbrook (1939) that fused needle is probably a distinct condition to that evidenced by general ill-health, and that the investigation of fused needle is of less importance than that of the latter more common condition, it is thought that such investigations are of considerable economic importance in that they are, in fact, enquiries into the causes of the ill-health of the worst-affected individuals of trees suffering from different manifestations of the one disease. Ludbrook (1939) has also considered that fused needle investigations are really more important with *Pinus tæda* and *P. caribæa*, since these are the two species most intensively planted in coastal Eastern Australia which exhibit the disease. This, however, is not necessarily the case, because, although the disease occurs commonly in its typical form with these two species, it is considered from observations recorded in New South Wales that other species—notably *Pinus radiata*—exhibit troubles which are probably identical in origin and occur with greater frequency.

Ludbrook was unable to find any significant differences in mycorhizas obtained from "healthy" and diseased trees, and was inclined to the opinion that it was, therefore, unlikely that any reliance could be placed on diagnosis by root studies. Through the courtesy of Dr. Ludbrook, the writer was able to examine a number of these sections. It was seen that both the typically fused and the unfused trees—the latter exhibiting, however, a generally poor and unsatisfactory type of growth—possessed an incorrect mycorhizal equipment. In all cases the fungal symbiont showed a definite parasitic picture, with abundant healthy, undisintegrated intercellular mycelia ramifying freely through the cortex of the roots. No Hartig net, as such, was visible, the cell walls having been disrupted by the penetrating hyphæ.

One preparation showed a healthy mycorhizal condition. This was made from roots of trees collected under an abnormally healthy (for that plantation) stand of *Pinus radiata*, growing at Belanglo, in New South Wales. In this case a typical Hartig network, with what appeared to be mycelia being digested by the so-called phagocytic action of the cortical root cells, was present. The short roots were enveloped by a fungal mantle of the usual healthy type.

SUSCEPTIBLE SPECIES.

Since 1935, when a list of species of *Pinus* susceptible to typical fused needle disease was published (Young, 1935), further additions to the number attacked have been made by Ludbrook (1937) and the writer, and the species now known to be susceptible are as follows:—*banksiana, caribœa, cembra, contorta, densiflora, echinata, excelsa, halepensis, insularis, lambertiana, luchuensis, montezumœ, muricata, palustris, patula, ponderosa, radiata, serotina,* and *sonderregerri.* The list composed by Ludbrook contains all these, save *patula* and *sonderregerri. Pinus patula* was first noted as being attacked by Rodgers (1931) in California, and later by the author in Queensland. The presence of the diseased condition in *P. sonderregerri* has been noted in Southern Queensland.

If the wider application of the term "fused needle" is accepted, it is considered that *Pinus pinaster* can also be included in the list of species subject to the disease. This pine often exhibits the poverty-stricken type of growth usually associated with fused needle in other species, although the typical fusion of the needles is absent. It can, therefore, be classified as a species exhibiting a disease type different from the typical picture presented by *Pinus tœda* and *P. muricata.* Sections of mycorhizas from this species collected in plantations in Southern New South Wales have shown the typical abnormal symptoms. *Pinus radiata* appears to be an intermediate type, which exhibits the typical form of the disease, but with a greater proportion of the non-fused type.

The order of susceptibility of the species of plantation importance in Queensland is as follows:—*Pinus tœda, P. caribœa, P. palustris,* and *P. patula. Pinus tœda* is relatively much more susceptible than any of the other three species noted; *P. palustris* is but infrequently affected: and it is rarely that an affected tree of *Pinus patula* is found. *Pinus radiata* is of little importance in Queensland, as the use of this tree as a plantation species has been abandoned owing to its unsatisfactory reaction to Queensland conditions as compared with other species.

(TO BE CONTINUED.)

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Passion Fruit Growing in Queensland.

H. BARNES, Director of Fruit Culture, and J. M. WILLS, Fruit Branch.

PASSION fruit growing has developed into an industry of considerable importance in Queensland. Once regarded largely as of minor consequence, it has now become with many fruitgrowers a main source of income.

Although in constant demand as a fresh-fruit market commodity, passion fruit is becoming of even more importance as a component in canned tropical fruit, salads, fruit drinks, and confectionery.

Though there are a number of varieties in existence in the State, only one—the purple-fruited *Passiflora edulis*—is grown commercially.

In some parts in the south-east of Queensland, hitherto regarded as essentially banana-growing and dairying districts, there is little virgin land left for banana-growing. Old plantations usually carry a good cover of grass, but at times, because of altitude and inaccessibility to dairy stock, they are unsuitable as grazing areas. On such areas, which otherwise may remain unutilised, the planting of passion fruit has already proved payable.

The passion vine is a vigorous and adaptable plant, but it does not follow that because of this plantings may merely be made at random and the vines allowed to grow without care. On the contrary, considerable attention is necessary in order to obtain the best results, and disappointment is the usual result of "hit or miss" methods of cultivation.

The prospective grower is recommended to commence with a small area, which may be afterwards increased. Four to five acres of vines is, generally, the maximum area one man can attend to, if horse-drawn or mechanically-driven cultivators are used. On less accessible sites, where hand-cultivation is the only practicable method, the area should be substantially less for efficient working; in such circumstances, two or three acres will be found quite large enough to occupy the full time of the grower.

Climatic Conditions.

The Queensland coastal climate, particularly in the south, is very suitable for passion fruit growing. The vine thrives under warm, humid conditions, such as prevail in the coastal area. Self-sown plants may commonly be found growing along the edges of rain forest clearings, roads, and snigging tracks, where they establish themselves with remarkable ease, and produce fruit of quality and quantity in competition with natural vegetation.

Under normal seasonal conditions, heavy rainfall assures sufficient soil moisture for most of the year for the maintenance of vigorous growth, the exception being perhaps in early spring. Attention to cultivation will usually offset any ill effects of a dry spring, but where it is prolonged into a dry summer some defoliation and loss of fruit may be expected. Some growers have found passion fruit growing profitable enough to warrant the installation of an irrigation plant.

In the south-eastern parts of Queensland, frosts occur on flat and low-lying land, but severe frosts are rare on hillside country. When deciding to grow passion fruit, this fact should be kept in view. Light frosts will do little harm to the vines, but a severe cold snap will kill the young top growth and may destroy the vines completely.

Plate 33.

An established passion fruit vineyard at Springbrook on one of the numerous small, richly fertile plateaux of the Macpherson Range, bordering New South Wales in the south-eastern sector of Queensland.

Plate 34.

A YOUNG PASSION FRUIT VINEYARD ON RED-OAK SOIL AT MUDGEERABA.

Cropping Habit.

Each crop is borne on new growth. The time which elapses between planting and first fruiting varies considerably, and depends chiefly on the time of planting and the strength and vigor of the vines. Vigorous plants commence to bear earlier than less robust ones, and may produce a few fruits at six months. As a general thing, however, vines planted in the early spring produce the first commercial crop in from twelve to fifteen months. When autumn planting is practised, a small crop may be borne the following summer or autumn, and the first big crop eighteen to twenty-one months after planting.

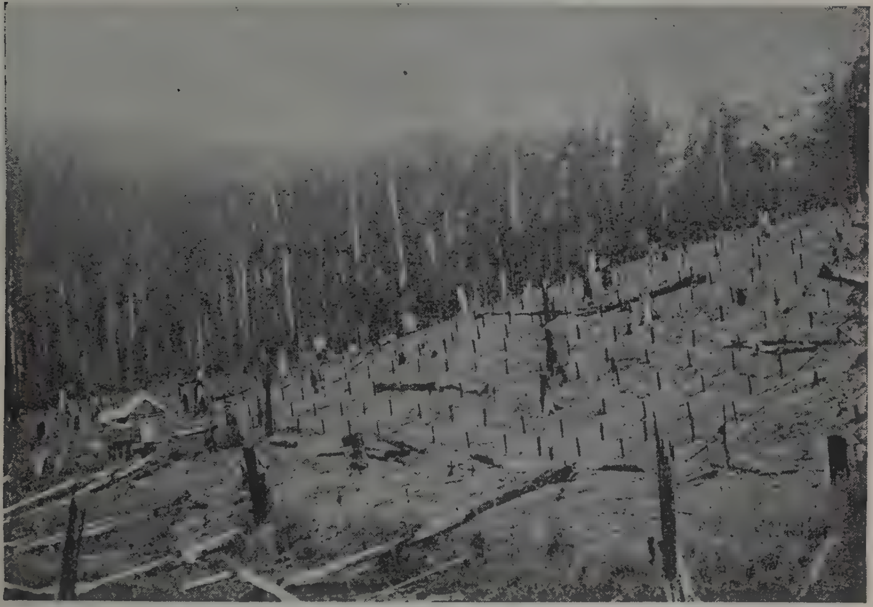


Plate 35.

A ONE-TIME BANANA PLANTATION TRELLISED FOR PASSION FRUIT VINES.

In favoured localities two crops are generally borne yearly—a main summer crop and a secondary winter crop. Approximately ten weeks elapse between the time of setting of the fruit to maturity. Blossoming occurs usually during August, September, and October for the summer crop, and during February and March for the winter crop. Marketing of the summer crop commences in October and may extend to January, with the heaviest pickings in November and December. The winter crop is usually harvested in May and June.

More or less continuous growth occurs in some years when weather conditions are favourable, and this results in the production of flowers and fruit right through the year. Occasionally, definite intermediate crops are obtained. The most evident of these is harvested during the months of February and March, following a November and December blossoming. These intermediate crops, although light, are usually very profitable, since they are marketed outside the periods of peak harvest. However, they are not normal, and are often followed by light settings of fruit for the main crops.

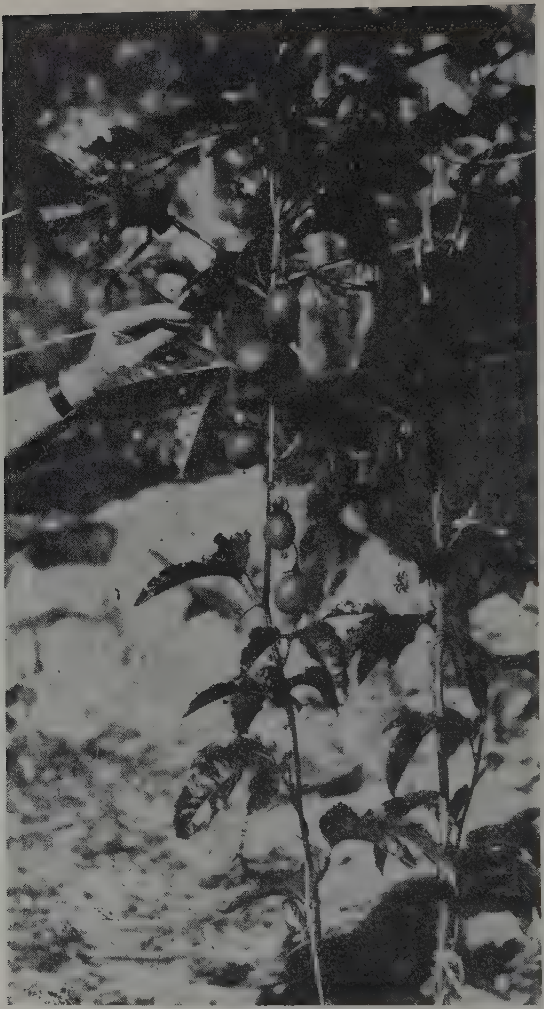


Plate 36.
A SIX-MONTHS OLD VINE SHOWING FIRST FRUIT.

At high altitudes of 1,500 to 2,000 feet above sea level, flowering and cropping habits vary very widely on individual plantations, being influenced by the immediate local conditions. In general there is a main summer crop, which matures later than that on lower lands, with a subsequent winter crop; but on some plantations there is continuous cropping and flowering all the year round. This is influenced to some extent by pruning and consequent forcing of new growth on which the flowers are borne. Other areas, which are exposed to cold winds or lack sufficient sunlight during the winter months, bear exceptionally late crops. On still other sites, the crops are matured very early, even before those on the low lands. Growers planting on such locations are fortunate in being able to harvest their fruit during a period when the market is in short supply, and when prices are consequently considerably higher than those prevailing during the period of peak harvests.

Plate 37.

VINE TEN MONTHS OLD SHOWING STURDY GROWTH OF TWIN LEADERS, DENSE VIGOROUS LATERALS, AND ADVANCED FRUIT.

Plate 38.

RISING GROUND ON ONE SIDE AND A SOLID BELT OF TIMBER PROVIDE GOOD PROTECTION FROM WINDS.

The profitable life of the vine is about four years when grown under proper cultural conditions. Maximum cropping is obtained with the second summer crop, following which the tendency is for the vines and the quality and appearance of the fruit to gradually deteriorate. Reasonably good crops may, however, still be obtained for another year or two.

Selection of Site for a Plantation.

Six important factors should be considered in selecting a site for a passion fruit plantation, viz., aspect, elevation, shelter, soil, drainage, and accessibility.

Aspect, elevation, and shelter generally will go together, as a good aspect is often elevated above frost level and sheltered from heavy winds. The aspect for preference should be from east to north, open to the morning sun, and backed by rising ground or dense natural timber to protect it from westerly and southerly winds. An aspect from east to north is naturally warmer, and this fact has a marked influence on the early maturity of the vines and the production of large crops of high grade fruit which colour and ripen evenly and rapidly. The exposed tops of ridges should be avoided where the soil has washed; vines rarely do well when planted on such situations.

Vines are not very exacting in respect of choice of soils. Any which are reasonably fertile are usually quite suitable, but it is of the greatest importance that they be well drained. Stagnant water at the roots and sour soil conditions are fatal. Soils on which vines are at present growing successfully range from rich rain forest to light scrub and forest soils. In the case of the first-mentioned, vines have a tendency to produce very heavy rank foliage which becomes rather a disadvantage, in so far that extra work is entailed keeping the growth within reasonable bounds and checking fungus diseases to which the vine is subject. Good scrub and forest lands produce vines of good average growth without the tendency to excessive foliage, while there is little, if any, difference in cropping propensities. Normally, forest and scrub soils do not possess as great an amount of humus as those of rain forest origin, and after being cleared of the natural timber for two or three years it may be observed that they dry out rather too quickly. This can be rectified, and the ground made to absorb and hold moisture better, by growing and turning in cover crops during the winter. In addition, the fertility and mechanical condition of the soil also will be improved.

In common with the banana, passion vines thrive on stony ground, and, except that cultivation is made more difficult, the presence of surface stone is not undesirable. Moreover, it has the advantages that it prevents soil erosion on hillsides, and assists in the retention of soil moisture and the maintenance of a higher soil temperature during winter. It is obvious that the latter is important in maintaining the vigor of the plants and inducing an earlier response to spring conditions.

Drainage.

Throughout the coastal districts in South Queensland there is a heavy yearly rainfall, but during normal wet seasons, half the annual fall may be precipitated during two or three months, hence the need for a well-drained soil.

Elevated and sloping sites are usually drained sufficiently, but drains across the slope should be made at intervals to carry surface run-off and control soil washing. These cross or contour drains should be as short as conveniently possible to avoid the necessity for having to carry too much water, and should have but a very gradual fall into main drains provided at intervals. By keeping the surface of the soil well broken up, absorption of rain is increased and the possibility of erosion is lessened.

On more or less level land where drainage is at all faulty, main drains up to 2 feet deep should be opened up at convenient intervals, and a series of shallower drains constructed to lead into them.

Accessibility.

The method of cultivation will be decided by the site selected. Mechanical or horse-drawn implements are, of course, more economical, but necessitate the thorough cleaning of the land in the first instance. The presence of logs, stumps, and stones makes hand cultivation necessary, with a corresponding increase in the time and labour required.

Plate 39.
PREPARING HILLSIDE LAND BY HAND FOR PASSION FRUIT.

When elevated sites are selected, the provision of a "flying-fox" or overhead wiring system will be found a great convenience for the quick and safe transport of fruit to the packing shed, and for this reason a suitable site for a shed should be found or provided. Instructions for the erection of a wiring system may be obtained on application to the Department of Agriculture and Stock, Brisbane. Where possible, the packing shed should be conveniently situated alongside a good road providing access at all times to a railway siding. It should be borne in mind that daily despatch of fruit to market is desirable and that any disorganisation of or delay in transport may result in considerable loss.

Preparation of the Land for Planting.

The land in which vines are to be planted should be well prepared in order that the young plants may establish themselves rapidly and develop a good root system which can traverse a greater area from which to draw available plant food. Where ploughing is possible, this should be well and deeply done, and the soil later worked down finely. On land which it is not possible to plough, the soil should be broken up by hand, mattocks or steel pronged forks being used for this purpose. Preparation should be completed by the end of August, so that any rain which falls will all be absorbed and the land will be in good condition for planting.

Coastal soils are known to be deficient in lime, and an application of from ½ ton to 1 ton per acre will assist in correcting acidity and generally improve the condition of the soil.

Mulching.

Paper mulch 18 inches wide is used in some localities to keep down weed growth around the young plants and under the trellises where mechanical or horse-drawn implements cannot be used and hand-clipping has to be done. The soil is prepared by forming "lands," that is, the ploughing of at least four furrows towards the centre, and, after breaking down the soil finely, laying the paper on these, care being taken to cover the edges with soil to prevent the paper being lifted and torn by the wind. Holes are punched in the paper at the required distances apart, and the plants set through them. The young plants should be watered in, the planter being careful to see that the crown is well clear of the soil.

Planting Distances and Trellising.

Eight to 10 feet is usually allowed between rows, and 15 to 16 feet between plants. The number of plants required to the acre at the various distances are: 8 feet by 15 feet = 363 plants, 8 feet by 16 feet = 343 plants, 10 feet by 15 feet = 290 plants, and 10 feet by 16 feet = 270 plants. In general, the more fertile the land the greater should be the distance apart within the limits shown above.

Nothing is to be gained by crowding the plants, which should be allowed room for a natural vigorous development and to permit of cultivation with implements where possible, without risking damage to the trellises even when wide spreaders are used on the horizontal type of trellis. Planting too close in the rows has little or no advantage, for after the first year the foliage of the vines will become too dense. It will then be necessary to cut out possibly, half the number of vines in order to keep the foliage sufficiently open to admit light and allow for the free circulation of air throughout the vine. Also, it is necessary to permit dead leaves to fall clear to the ground, carrying with them perhaps fungus spores which would more readily infect other portions of the plant if allowed to remain caught up in a mass of foliage on the trellis.

For the proper development and ripening of the fruit sunshine and air should penetrate to all aerial parts of the vine, hence the necessity, wherever possible, for running the trellises in a north-south direction. The vines will then have an even distribution of sunlight over the whole of the growth on the trellis. On hillside plantations it is not always possible nor desirable to adhere to this rule, since factors such as the conservation of surface soil are all important. Less erosion is likely to follow where the vines are planted across the slopes and

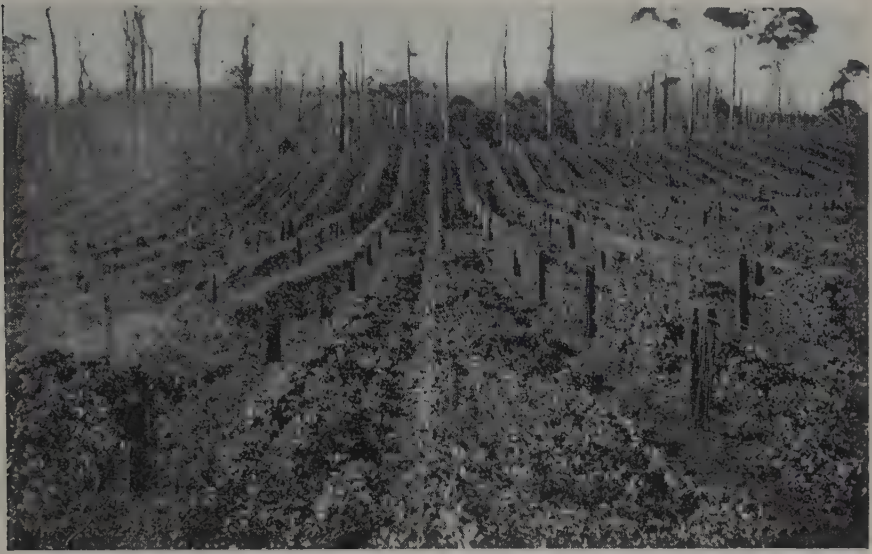


Plate 40.

VINES PLANTED UP AND DOWN THE SLOPE.—Note the green cover crop to improve the soil and check erosion.

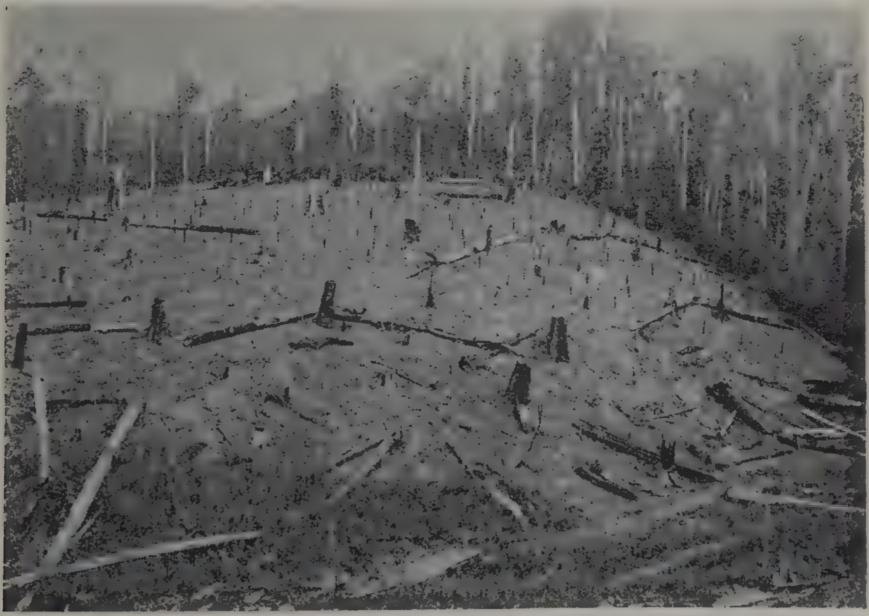


Plate 41.

RAIN FOREST OR "SCRUB" LAND CLEARED FOR PLANTING.—To assist in conserving surface soil, the unburnt logs should be placed across the slope.

the soil hilled along the rows with cultivation. Any stones, unburnt logs, &c., should also be placed in the rows. Each row will thus eventually provide a surface drain which will carry off its share of excess water during periods of heavy rain.

In commercial vineyards, trellises are mainly of two types, the vertical and the horizontal. Both have advantages and disadvantages, but on the whole the horizontal is considered the more suitable. The outlay for wire, posts, and strainers and their erection is a factor which often influences the type of trellis to be erected. A vertical trellis is less costly, and therefore if posts and strainers have to be purchased, many growers erect this kind of trellis at first, and for later plantings use the horizontal type. Wherever it is possible for a grower to split and erect his own posts and strainers, a considerable saving will result. Usually there is plenty of suitable timber growing handy. Most of the natural hardwoods last longer than the passion vines, and may therefore be safely used, but if selection is possible posts should be split from bloodwood, ironbark, grey gum, or yellow stringy. These timbers will last for many years.

Substantial trellises only should be erected, because they must bear a heavy weight of vine and fruit. The top wire in whatever kind of trellis is built should be not less than 6 feet from the ground in order to permit plenty of room for fruit-bearing laterals and to allow them ample light and air.

In a horizontal trellis (Plate 42) the two wires are run side by side, while in a vertical trellis the wires are run one above the other as in an ordinary fence. The posts for the trellis should be 7 feet 6 inches long, 7 inches wide, and about 4 inches thick. They should be set 18 inches in the ground, and 15 or 16 feet apart, dependent on the distance apart it has been decided to plant the vines.

The strainer posts should be of much heavier timber, and may be either round or split. They should be set 2 feet 6 inches in the ground, and must be well strutted or stayed, so as to take the strain of the wires, the portion in the ground to be free of sapwood. One strainer to every 80 yards will prove sufficient in most locations. The posts should be erected with their width across the row.

For a vertical trellis (Plate 43) holes are bored in the posts through which the wire is run. One wire is run as close to the top of the post as practicable, and a second and sometimes third wire is run usually at 12 and 18 inch spacings below, 15 inches being the average spacing between these wires.

As stated previously, the horizontal type of trellis is considered most suitable. The distance between the two wires may be anything from 9 to 24 inches, but wide spacing has the advantage over the closer method in that it permits the entry of sunlight and air between the two sets of laterals, thus promoting the flowering and setting of fruit on the inner growth of the vine. At the same time this practice assists materially in maintaining a more open growth, allowing dead and diseased leaves to fall clear to the ground, carrying with them any fungus spores adhering to their surfaces.

In order to keep the wires apart in a horizontal trellis, a T-piece not less than 2 inches by 2 inches, cut to the length desired, is fastened to the top of the post and the wires run through holes bored in the ends of the T-pieces and strained on the strainer posts.

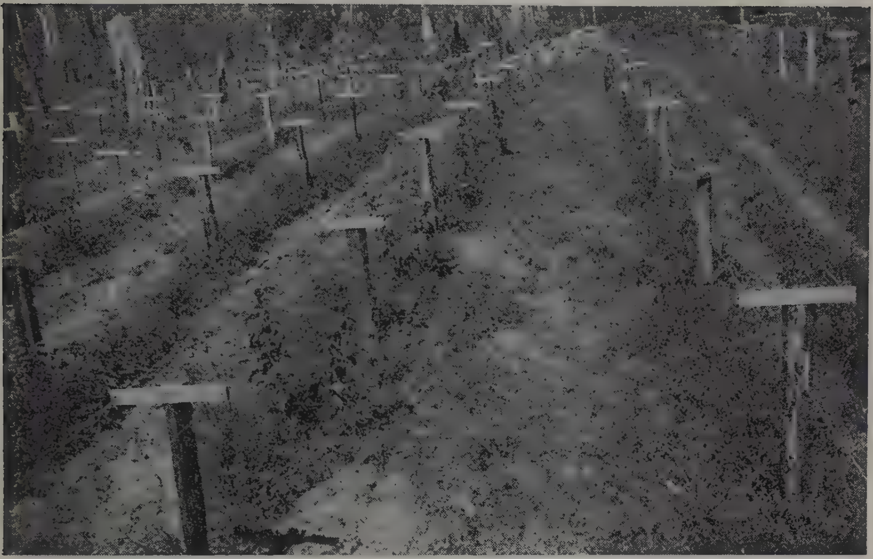


Plate 42.
HORIZONTAL OR "T" TYPE OF TRELLIS WITH TWO WIRES.

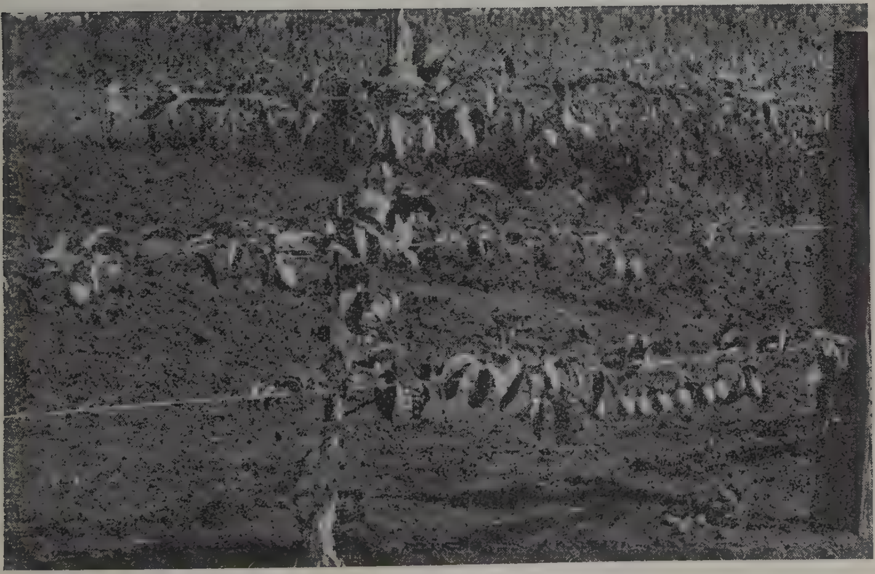


Plate 43.
VERTICAL OR FENCE TYPE OF TRELLIS WITH THREE WIRES.

It is an advantage to make some provision whereby the wires can be kept strained, and so prevent heavily-laden laterals from sagging to the ground. Small cast-iron rollers (Plate 44) may be procured cheaply and are excellent for this purpose, being easily operated and always in position.

Various gauges of wire are used. Some growers prefer No. 8 galvanised iron wire, while on some of the more recently erected trellises 10 by 12 gauge high tension steel wire has been used. This wire, although rather thin, is very strong and carries the weight satisfactorily; also, there is less stretching and sagging between the posts than is the case with iron wire. Black iron wire, although cheaper to buy, should not be used, as it soon rusts, stretches, and sags, necessitating propping up between the posts in order to keep the laterals and fruit clear of the ground.

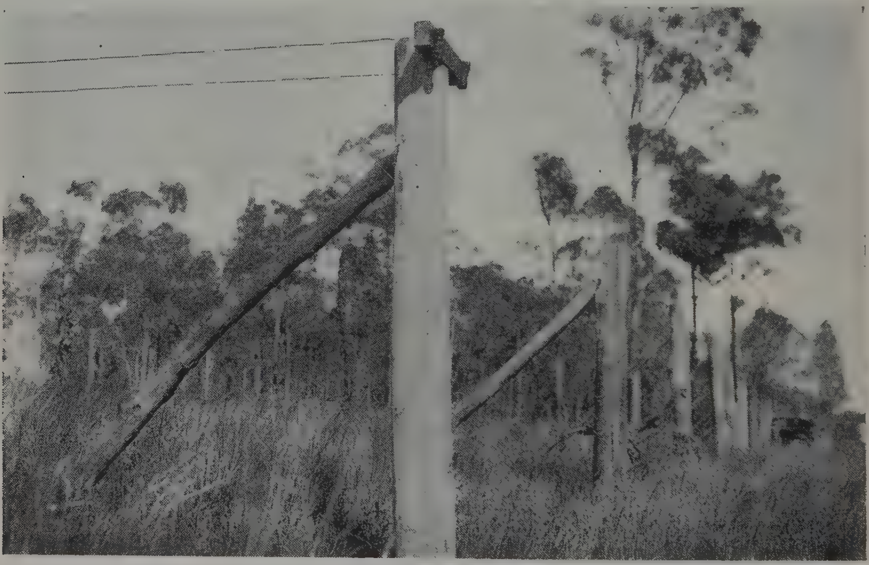


Plate 44.

TRELLISES MUST BE WELL STAYED.—Note cast-iron rollers by means of which the wires can be easily strained.

Should the wires sag between the posts, stakes may be placed temporarily in position to support the wire until the crop has been harvested; then, after pruning, when the weight on the trellis has been reduced, the wires may be restrained with little possibility of the wire snapping.

An Extension Trellis.

The recommended practice is to keep lateral growth of the vines off the ground, and growers are advised to cut back vigorous growths to within 6 inches of the soil surface. When vines lie on the ground the fruit becomes badly scarred and of little value, except as low-grade or factory fruit. Shortening of laterals undoubtedly removes a considerable amount of growth capable of carrying fruit, and the following description of a temporary extension trellis shows how it is possible to increase the length of laterals without hampering cultural, spraying, or harvesting work, and enables a grower to get a higher yield of high-grade fruit from his vines.

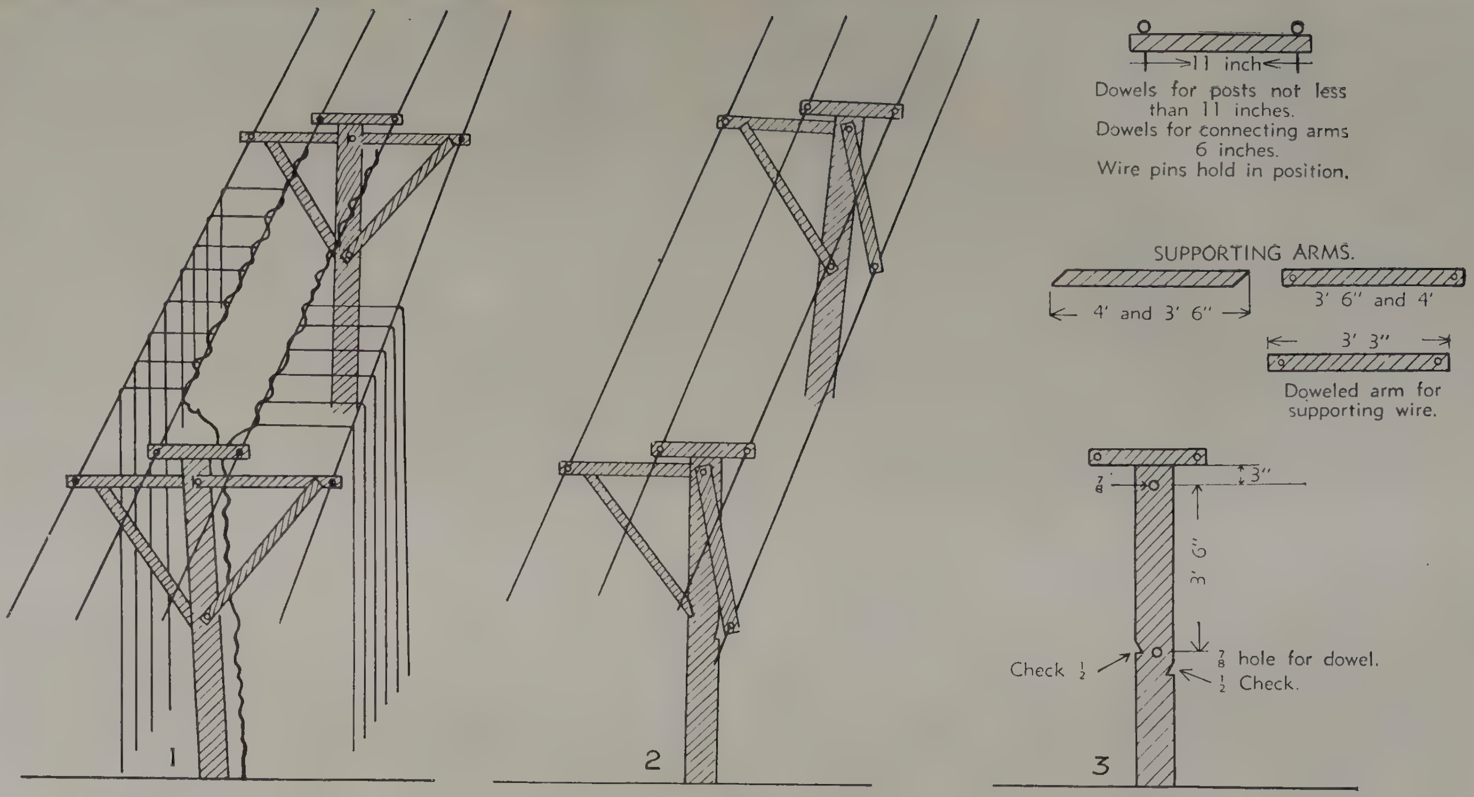

11 inch
Dowels for posts not less than 11 inches.
Dowels for connecting arms 6 inches.
Wire pins hold in position.
SUPPORTING ARMS.
4' and 3' 6"
3' 6" and 4'
3' 3"
Doweled arm for supporting wire.
3"
7/8
3' 6"
7/8 hole for dowel.
1/2 Check.
Check 1/2
1
2
3

Plate 45.

DIAGRAM SHOWING HOW THE EXTENSION TRELLIS IS ATTACHED TO THE MAIN TRELLIS.

Plate 45 illustrates a simple way of attaching an extension set of wires to existing trellises. This extension system makes possible increased lateral growth for an extra 2 feet on each side of the vine, or giving a net gain of 4 feet over the whole lateral growth of the vine. In addition, the extra shade provided by the extension gives greater protection from the direct rays of the sun for the main stem of the vine; this is very noticeable where trellises are 6 feet or more above the ground. Moreover, a greater area of ground is shaded during hot weather, and this helps to keep the surface soil at a moderate temperature, reduces the loss of moisture through evaporation, and makes weed control easier, thus reducing chipping costs and allowing more time for spraying and other jobs. After the fruit has been picked, and, if seasonal conditions are suitable, the bearing laterals should be pruned right back. The extension trellis can then be lowered out of the way beside the trellis posts, thus allowing full use of the space between the rows of vines for the planting of small crops or the planting of green cover crops. When the new laterals have grown sufficiently to warrant its re-erection, the extension trellis can be raised into position again, the wire automatically picking up the lateral growth as it is strained to the proper tension.

The measurements given in the diagram are suitable for trellises where the rows are planted 8 feet apart. Where the planting distance is wider, the length of components may be increased. The system can be installed on either horizontal twin-wire trellises or on the vertical fence type; in the latter type, however, only the laterals from the leaders on the top wire should be trained over the extension. If sawn timber is used, approximately 15 feet of 2 inch by 1 inch hardwood battening is needed for an extension at each supporting post in the trellis, viz.—

2 horizontal arms to support wire, each 3 feet 3 inches;
2 supporting members, each 3 feet 6 inches to 4 feet.

The few inches left over will provide sufficient material to make the dowels, which are cheaper than bolts and nuts. A $\frac{7}{8}$-inch hole should be bored about 3 inches below the top of the post to allow for the wooden dowel on which the extension arms hinge. Of course, holes of similar size are bored in one end of each extension arm, a smaller hole for the wire to pass through being bored at the other end. The arms are set on opposite sides of the post as illustrated. Dowelling is strongly recommended, because the supports are not likely to be knocked out of the check notches during rough weather or when working among the vines.

The extension arms should be at least 3 feet 3 inches, or up to 3 feet 6 inches if desired, and this should allow sufficient room for the grower to reach the centre of the trellis from either side of the vine, in order to prevent the vine growth from matting and harbouring disease-infected leaves; at the same time, sufficient space is left to pass up and down the rows between the sets of trellis.

The supporting arms should be set at such an angle as to ensure the maximum support. Wooden dowels on which the arms are hinged should be sufficiently long to allow a small hole being bored at each end. Through these a nail or wire pin can be pushed, thus holding the arms in position. The same applies to the dowel holding the arms together near the end through which the wire runs.

No. 10 gauge galvanised wire is suitable for the extension. It should be strained when the arms have been dowelled in position, sufficient length being left at the strainer post so that it can be slackened off slightly when the extension is not in use. Small iron rollers suitable for straining the wire can be purchased cheaply. The wire for the extension is run through the straining post used for the main trellis. No extension arms should be attached to the strainer. The strain on the wire should be just sufficient to support the weight of laterals without sagging between posts. When the extension is not required it may be dropped to hang down alongside the post, the dowels holding the arms together near the wire being removed to facilitate this.

It is not necessary to completely dismantle the extension if the wood used is hardwood, but if softwood is used then it should be dismantled and stored until needed again. If the system is dismantled it will be necessary to mark or number each row and each section of the extension; the posts also from which it is removed should have identification marks so that when required again each member can be re-erected in its original position.

Propagation.

Passion fruit plants may be propagated either from seed or cuttings, though the latter practice is rare. Growers are recommended to raise their own plants, and for this purpose only fully matured fruits selected from healthy vigorous vines should be used. Great care should be given to the selection of the fruits for seed purposes, as the passion vine is subject to several diseases and the possibility of transmitting these diseases by seed cannot be ignored. The seed may be allowed to remain in the fruit, which will naturally dry up, until it is required for planting. Another method is to remove the pulp, place it is a vessel of water for a few days until it ferments, when the seeds will easily separate from the fruit pulp. The seeds should then be washed in clean water and placed in the shade to dry.

Should early spring-ripened fruits be selected and the seeds planted immediately, seedlings will be ready to plant out in summer. A later sowing would provide seedlings suitable for autumn transplanting.

If spring planting is desired—this being the season most preferred—then seedlings should be raised from fruits maturing in the previous late summer. Such seedlings should be well grown before winter and be available when seasonal conditions are suitable for transplanting with every prospect of the young vines rapidly establishing themselves in their new situation. The site of the seed-bed should be very carefully selected. It should not be in close proximity to any other passion vines, either cultivated or otherwise, owing to the possibility of introducing woodiness or other diseases into the nursery. The soil should be friable and contain an abundance of plant food. After the soil has been well worked into a fine state of tilth, the seeds should be planted about half-an-inch deep in shallow drills made about 9 inches apart, the soil afterwards being firmly pressed and covered with half-an-inch of fine horse manure as a mulch. The seedlings should appear in from four to six weeks, and as they develop they may be thinned out to about 4 inches apart; those remaining will then develop into sturdy plants with good root development. Lanky, weak plants will result from any crowding in the seed-bed.

Some growers first erect the trellis and then plant several seeds at the required planting distance under the trellis, afterwards selecting the most vigorous of their young plants and removing the others. This practice is not recommended. Germination is often poor, the young plants are exposed to infection from any diseased vines which may be in the vineyard, and, generally, they require extra attention until they become well established.

Transplanting actually may be done at any time during the year, but from September to February is recommended, with a preference for the spring months. March to August planting is generally not advisable, except in very warm situations, as the plants often do not establish themselves satisfactorily and remain stunted.

When plants have reached a height of about 9 inches, they may be safely transplanted. If they have been allowed to grow much more than this, about a fortnight before transplanting the excessive top growth should be cut back and the larger roots severed by pushing a spade down full depth between the rows.

Transplanting.

Dull, cool or moist weather is better for transplanting than hot, sunny or windy days. Under the latter conditions evaporation of moisture from the young plants is likely to be excessive. Except when the plants are set through paper mulch, it is advisable to dig large-sized holes for the reception of the plants. Approximately 12 inches in diameter and 12 inches deep is best. The position of each hole should be midway between the trellis posts. When planting, spread the roots evenly in a downward direction at about 45 degrees, and fill in fine top soil, which should then be well firmed. When the hole is completely filled with soil, the plants should be growing at approximately the same depth as they were in the nursery, but not deeper. If planted too deeply the crown of the plant is likely to be attacked by a fungus rot, which will destroy it.

Only as many plants as can be planted within an hour or two should be dug from the bed at one time, and after removal from the nursery they should be kept continually covered with a wet sack until planted. It is a good plan to give the bed a thorough soaking with water the day before digging the plants. The roots of the seedlings will leave the bed more easily, and will not be excessively damaged. They will also absorb moisture, which will assist them to recover from the shock of transplanting.

Training the Vine.

From the beginning the grower should have a definite system in mind, and train the vine systematically, so that a good solid framework is modelled on the trellis.

Within a few weeks after transplanting the young seedlings will have become established and vigorous growth will develop. Numerous shoots will appear from the crown of the plant and in most cases they rapidly overtake the original growth of the vine. When they have attained a growth of from 12 to 18 inches, one, two, or four (according to the grower's wishes) of the most vigorous growths should be selected to form the main stems of the vine. All other growth should then be carefully cut away. Light stakes or poles should be driven into the ground alongside the young seedlings and fastened firmly at the top to the wires on the trellis. The stakes act as supports for the vine until they have become firmly established on the wires. With the growth of the stems it is necessary to keep them tied at intervals of 9 to 12 inches to the stakes in order to prevent them from being broken or damaged through being blown about by wind.

Plate 46.

LIGHT STAKES SHOULD BE USED AS SUPPORTS FOR THE VINES UNTIL THEY HAVE BECOME FIRMLY ESTABLISHED ON THE WIRES.

The common practice with growers is to tie the vines after giving them a twist round the stakes. This is not the best method, because it necessitates at a later stage searching for the ties and removing them: if they are permitted to remain, they may cincture the vines as they grow. The best way is to tie a leaf stalk and tendril to the stakes, leaving the main stems clear of the ties. This is equally efficient as tying the stems, and avoids the necessity for later removal of the ties. Some extra time may be necessarily spent in the first place, but it will be more than made up later on.

Pieces of strong sacking cut into squares about 6 inches by 6 inches will unravel easily, and the strands make quite good ties.

All side branches arising from the stems between the ground and the wires should be carefully suppressed. Leaves only on the stems between the ground and the wires should be allowed to remain; these shade the stem and aid the development of the young plants.

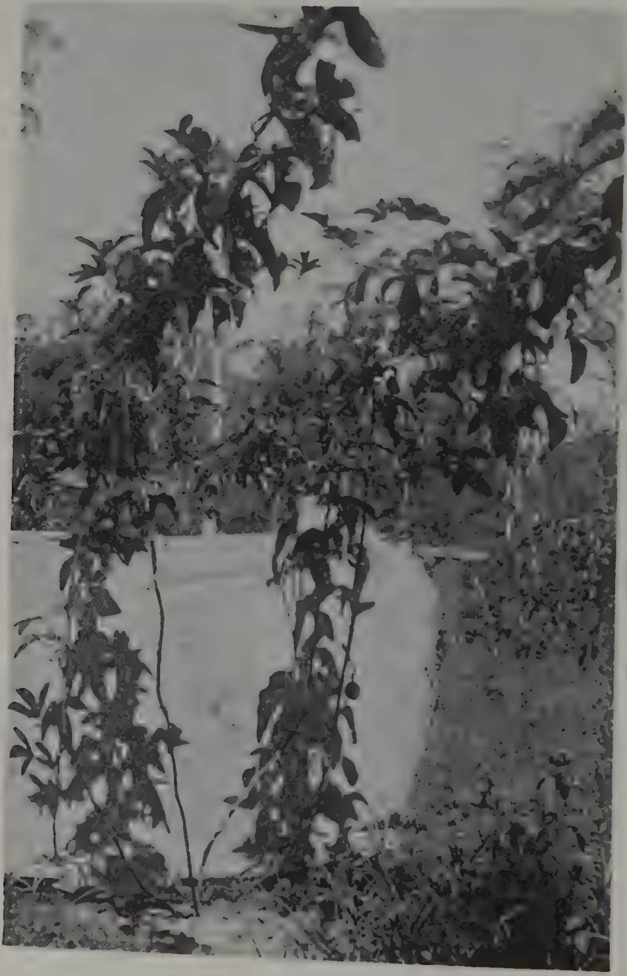


Plate 47.

SHOWING THE DEVELOPMENT OF FOUR STEMS.

Each grower must decide for himself whether he prefers one, two or four stems, but two stems are considered most satisfactory. The vines cover the trellis with comparative rapidity, and if planted in the spring produce a good crop in twelve to fifteen months. In addition, there is the advantage that, if one stem is damaged through any cause, the vine is not completely lost, the second stem remaining to carry on until a new stem or new leader is produced. It is important that the stems be as nearly as possible the same size, otherwise the more vigorous stem will rob the smaller and outgrow it. Vines trained on a single main stem take longer to establish a complete cover on the trellis, but during early life are much easier to keep in control, as the growth is not nearly so dense as that developed by the multiple stem system. On sloping land, where trellises may for some reason have been erected up and down the slope, two leaders are best, and as vines always grow more vigorously up hill than down, they should be trained on the wires to grow in the direction of the top of the plantation.

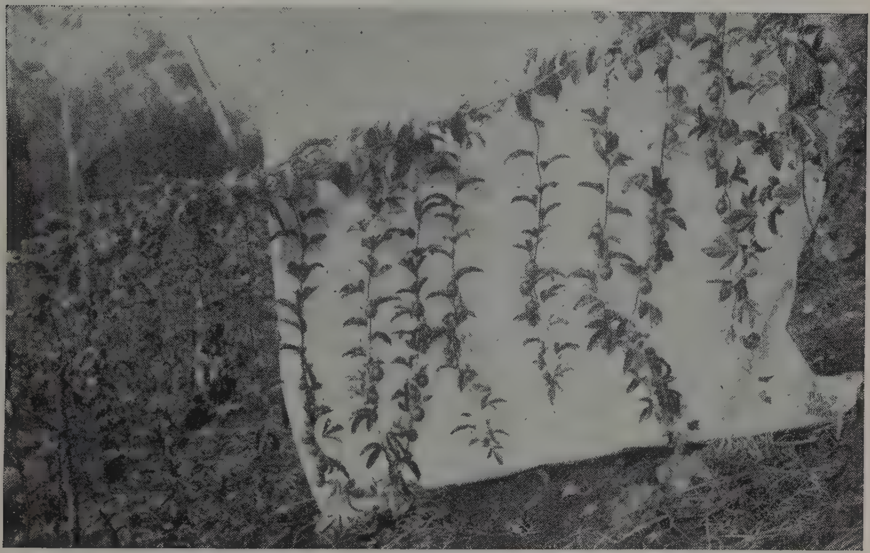


Plate 48.

LATERALS WHEN TRAINED TO GROW STRAIGHT DOWNWARD ASSIST IN KEEPING THE VINE OPEN, AND THE WORK OF SPRAYING, HARVESTING, AND PRUNING IS SIMPLIFIED.

Training on the Vertical Trellis.

In the case of the vertical trellis, if only one stem is left it should be allowed to grow until it reaches the bottom wire, when the top inch or so should be pinched out. The stem will then throw out side branches near the top. Three, or perhaps four, of these should be selected, growing as near to one another as possible. Two should be trained in opposite directions along the bottom wire, and the other one or two carried on to the top wire where, if only one is carried on, the tip should be again pinched out and two side branches allowed to grow for training in opposite directions along the top wire. If two branches are carried on from the bottom wire, they are merely trained in opposite directions along the top wire.

When two main stems are allowed to grow from the ground, the tip of one should be pinched out on reaching the bottom wire and two branches allowed to develop for training along the bottom wire, whilst the second stem is permitted to grow until it reaches the top wire where it is similarly treated.

In the case of four main stems, two are trained in opposite directions along each of the wires.

Training on the Horizontal Trellis.

With the horizontal trellis, if only one stem is left the tip should be pinched out when the wires are reached, and four branches growing as close together as possible should be allowed to develop for training in opposite directions along the two wires.

If two stems are left, the tips are pinched out and two branches allowed to grow from each, whilst with four stems they are merely trained in opposite directions along the wires as they reach them.

The sections of the vines which grow along the wires are termed "leaders." They should not be permitted to ramble along the wires at will supported only by the tendrils, but should be given long, gradual turns round the wires and loosely tied at intervals, care being taken to maintain the turning in the same direction to prevent sagging loops. Sharp turning round the wires should also be avoided, as this may tend to check the sap flow. As the leaders proceed along the wires, lateral growth will develop, and this will be accelerated if leader terminals are nipped out on reaching the approaching growth of the neighbouring vine.

The laterals should be encouraged to grow straight down rather than be allowed to grow in any direction. By controlling the laterals in this way the vines are kept more open, and the work of spraying, harvesting, and pruning is made very much easier.

Other Forms of Trellis.

Apart from the vertical and horizontal trellises described, there are a number of modifications which some growers adopt with varying results. In the main they are more expensive to erect, and it is doubtful whether recompense is obtained for the additional outlay.

Plate 49 illustrates a horizontal trellis with three wires. Two leaders are grown along the middle wire and the side laterals are trained over the outside wires.

Plate 50 shows another form of horizontal trellis with four wires in which four leaders are grown along the inside wires and the side laterals trained over those outside. This system permits of wider cross pieces being used on the trellises, but often results in a mat or shelf of vines on the top of the trellis, which holds dead and diseased leaves instead of permitting them to fall to the ground.

Plate 51 shows a six-wire vertical type of trellis on which twelve leaders are allowed to grow. The use of a trellis, such as this, results in the side laterals from the top leaders tending to exclude light and air, and consequently smothering those on the bottom wires.

Plate 52 illustrates a trellis made with welded sheep fencing. This type is used in Victoria, where the growth of vines is very slow in comparison with their vigorous development in Queensland. The stems or leaders are spread fanwise over the wires. Good crops are borne and the vines are well spread, but considerably more time is occupied with pruning than when the two-wire horizontal or vertical trellis is used.

Cultivation.

Caution is needed in regard to the use of cultivation implements, especially when the vines are in vigorous growth. Passion vines are comparatively shallow rooted, and not a few growers have suffered considerable loss when, with the best intentions in the world, they have

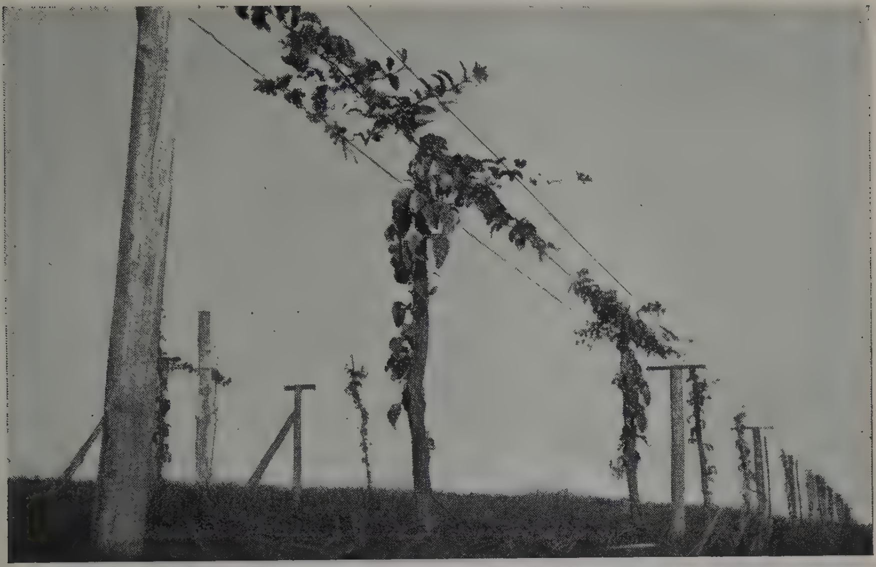


Plate 49.
A HORIZONTAL TRELLIS WITH THREE WIRES.

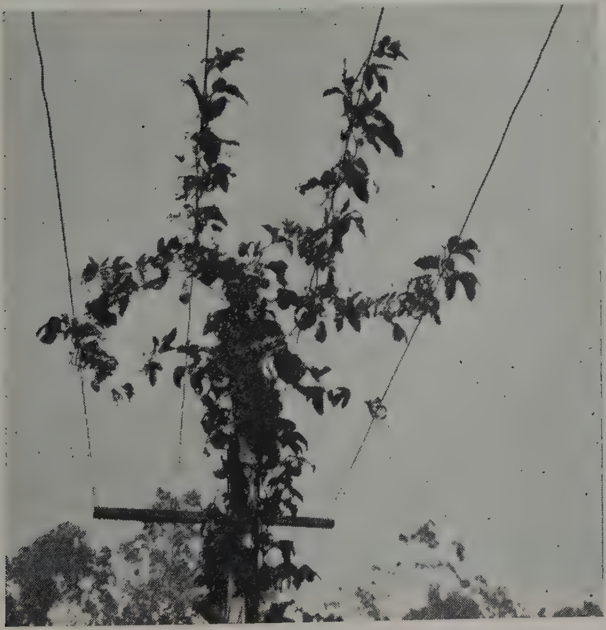


Plate 50.
A HORIZONTAL TRELLIS WITH FOUR WIRES.

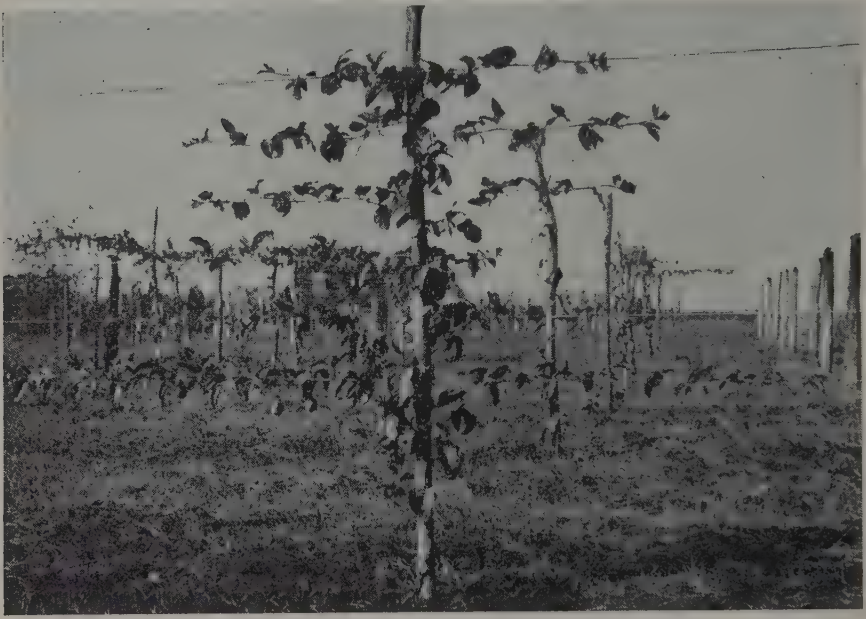


Plate 51.
A SIX-WIRE VERTICAL TYPE TRELLIS.

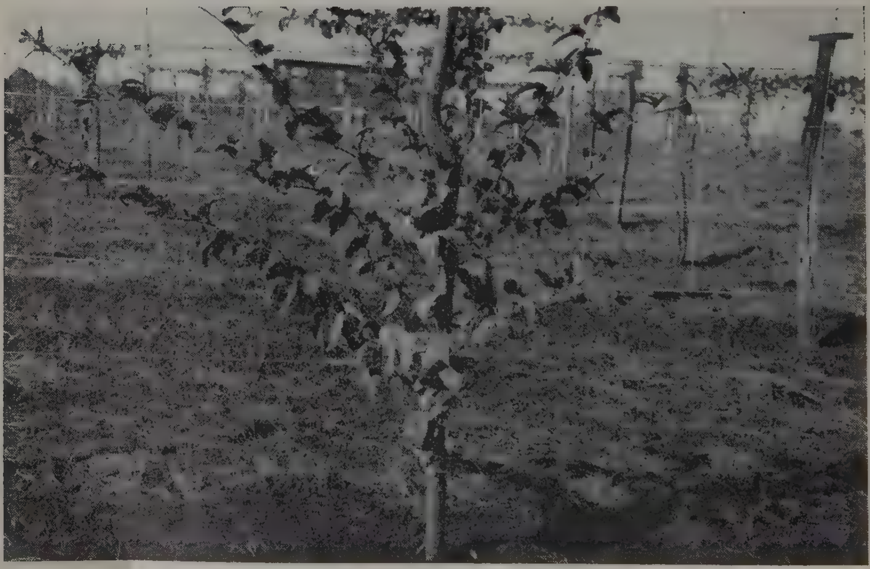


Plate 52.
A TRELLIS MADE WITH WELDED SHEEP FENCING WIRE.—The leaders are spread fanwise.

ploughed or cultivated deeply at a time when a good crop was hanging, and afterwards found their fruit just withered and fell, and the vines assumed a sickly yellow appearance. Such a condition will follow the cutting and breaking of feeding roots at a time when the vines most need their support. Cultivation, then, during the main growing and fruiting periods should be shallow and confined merely to the control of weeds and the breaking-up of the top inch or so of surface soil to prevent caking.

It is more or less essential to break up the soil deeply once a year, and this is best done during the winter about July after the vines have been pruned. Where horse or tractor drawn implements are used, the land up to within 18 to 24 inches of the vines may be ploughed to a depth of about 6 inches, whilst on steep and rough locations, or where the land has not been stumped, cultivation as deeply as possible up to the same depth is best achieved by the use of mattocks or pronged hoes.

Plate 53.

DEEP CULTIVATION SHOULD ONLY BE CARRIED OUT TOWARDS THE END OF WINTER.—Note that these vines were pruned before being given a thorough cultivation.

Care is also essential when attempting light cultivation or weed control around the immediate base of the vines in order to ensure that the crown and main roots are not injured by implements. Soil-frequenting fungal organisms often quickly enter at such points of injury and set up a condition known as base rot. It is preferable to hand pull all weeds in the vicinity of the stems. Furthermore, during cultivation the crown of the vines should not be covered with soil or with destroyed weed growth, but left exposed to the sun and air. Little trouble will then be encountered with base rot.

Vines should be kept well cultivated along the lines set out from the time they are planted. They will then develop rapidly and produce good crops. Vines insufficiently cared for when young lack vigour, and their development is retarded. Even if they do produce a large quantity of fruit, it is usually small and of poor quality. Older vines will also suffer during hot dry spells if cultivation is neglected, as the soil cannot hold sufficient moisture at such times to support both vines and weeds.

Green Manuring.

The growing of green manure crops planted between the trellises towards the end of summer and prior to the wet season is a matter which should be given attention. Crops such as cowpea, Poona pea, tick beans, field peas, mustard, lupins, and others are suitable. If grown through the wet season and into the winter, they will not seriously interfere with the growth of the vines, they will assist in controlling erosion, and when turned under will materially assist in improving the fertility of the soil. On soils of good to medium fertility a dressing of about 200 lb. of superphosphate to the acre at the time of sowing the seed will be of considerable assistance in the production of a good cover.

Plate 54.
RECONDITIONING PASSION VINE SOILS.—Green-manure crop of mustard ready for turning under.

On poorer soils or in vineyards which have been badly washed, or where hot fires have occurred, the condition of the soil can be improved by turning under green cover crops. On badly washed areas where difficulty may be experienced in getting legumes, such as cowpeas and Poona peas to grow, mustard will generally provide a good first crop, subsequently peas may be planted successfully. Cover crops on poor soils will be materially assisted with a preliminary dressing of 200 lb. each of sulphate of ammonia and superphosphate.

Plate 55.

A GOOD CROP OF SKINLESS BARLEY IN A YOUNG PLANTATION, PLOUGHED UNDER IN FEBRUARY.

Plate 56.

AFTER THE VINES HAVE COVERED THE TRELLISES, COVER CROPPING SHOULD BE CONFINED TO NARROW STRIPS DOWN THE MIDDLE OF THE ROWS.

Plate 55 illustrates a good crop of skinless barley planted between young vines, after it has been ploughed under in February. The land was wonderfully benefited from this crop. It should be noted, however, that after the vines have covered the trellises, ploughing in February should be limited to the middle of the rows, as the root system of the vines will have extended well out by that time. Green crops, planted subsequent to the first year's growth of the vines, should be confined to a narrow strip along the middle of the rows as shown in Plate 56.

Irrigation.

Earlier it was mentioned that, if a dry spring extends into a hot, dry summer, some defoliation and loss of fruit must result. The provision of irrigation water where available will prove an entire guard against such a setback, and will prove profitable in other ways in so far that the vnes can be kept growing and blossoming practically throughout the year. It will be noted under the heading of pruning that the time for doing this work is governed to some extent by prevailing weather conditions. Aided by irrigation, this handicap disappears. The vines can be well watered prior to pruning, and again after the operation without danger of suffering any check, and furthermore, can be forced into growth at once for the production of an early crop. Furrow irrigation is to be preferred where the land is nearly level, but on sloping land overhead spraying is quite successful.

During very dry periods, the owners of some plantations resort to hand watering where irrigation is not possible, and it is remarkable how about a quart of water poured round the stem of each vine every second day will enable the plants to retain not only foliage, but fruit. The watering is best done late in the afternoon to avoid loss by evaporation.

Fertilizing.

The passion vine, being a vigorous grower, demands a plentiful supply of available plant food. The soil, therefore, should be at least reasonably fertile. Where planted on good virgin land there should be ample nutritive elements available for the first year or two. Subsequently, and also from the outset on poorer areas, artificial fertilizers will prove of considerable benefit.

A recommendation as to the best formula to use for all plantations cannot be made dogmatically, for better results have been obtained by the application of certain mixtures on some areas, whereas other mixtures have been equally successful in other plantations. Each grower, whilst applying a general mixture to his vines, should carry on small scale experiments with others and note any difference. The amount of fertilizer required will depend to some extent on the fertility of the land, poorer areas requiring more than those of better quality, but from 4 cwt. to 8 cwt. per acre will prove a reasonable application.

The various fertilizer dealers stock general orchard mixtures which have given good results in many instances, whilst other growers experimenting with a special 10-6-10 mixture of sulphate of ammonia, superphosphate and sulphate of potash have produced excellent crops. Whatever fertilizers are applied are best divided into two dressings, one during the winter cultivation about July, and a second about January, in order to be in time for the autumn flowering for the winter crop.

Pruning.

Some growers claim that pruning definitely gives them bigger and better crops, others say they get just as big crops from unpruned vines, but admit that the size of the fruit and its quality is not as good as that from pruned vines. In any case, whatever influence pruning has on the size of crops, the wise grower will prune for the following reasons:—

To keep the vine in good health;

To remove diseased, dead, and unprofitable growth;

To keep the growth in check on the wires in order to admit light and air and prevent congestion;

To induce the production of healthy, vigorous wood on which high-grade fruit is set;

To replace spent, bare leaders by the development of new ones;

To keep the lateral growth clear of the ground and properly spaced;

To regulate the time of bearing so that the highest market prices are obtained for the fruit;

To assist disease control and increase the life of the vine;

To cheapen the cost of spraying.

When left unpruned, vines soon become a tangled mass of wood and foliage in which fungus diseases may develop and rapidly shorten the life of the vine. It is essential, therefore, to maintain an open habit of growth in order to admit plenty of light and air to all parts. All dead and diseased wood should be cut away and burnt in order to reduce the risk of infection. The best fruit is produced on healthy vigorous laterals, and the object naturally is to produce the greatest amount of such growth possible. It will be found that, by checking the growth of laterals when they are about 6 inches from the ground, strong secondary laterals on which fruit will be borne will be produced all along the sides of the laterals, and the bearing area of the vine will be thus increased considerably. In addition, the vine will be kept free of the blemished fruit which would be produced if the laterals were permitted to grow on the ground. The checking of laterals to keep them clear of the ground may be done at any time without harming the vine.

Passion vines should be given a heavy pruning once each year. There are modifications in some instances which are discussed later on. Usually, July or August is the best time, when most of the winter crop has been harvested, and before spring growth commences. The most suitable time for commencement of pruning will vary in different districts, and possibly even in different parts of the same district, due to environmental factors bearing on growth and crops, as described earlier. A most important feature also to be borne in mind is that *vines should not be severely pruned during a very dry spell.* The soil should be in good condition so far as moisture is concerned. Severe pruning when the ground is dry has caused the death of many vines. Pruning at about the time mentioned is preferable from the aspect of control of a serious fungus disease known as Brown Spot, information concerning which is obtainable upon application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

There are no hard and fast rules for pruning. Each vine may present a different problem, and consequently only general recommendations as to the procedure will be discussed. It should perhaps be mentioned that pruning is apt to prove a slow and tedious job, and much patience is required to do the work properly. However, the grower will be well repaid for the time and care expended. Firstly, with the aid of a reaping hook, all laterals should be severed at about 12 inches below the trellis wires. When this has been done, the great bulk of the vine has been removed, and it is possible to obtain a much clearer view of the more intimate pruning required. From the leaders on the wires all dead, diseased, and spindly wood should now be cut away, using a pair of secateurs, and the stumps of the stronger laterals which it is intended to leave should be allowed to remain about 9 to 12 inches long. Each shortened lateral will then have two or three buds from which the new growth will start for the next crop. It is not advisable to cut back more severely than this, as the bearing capacity of the vine may be affected.

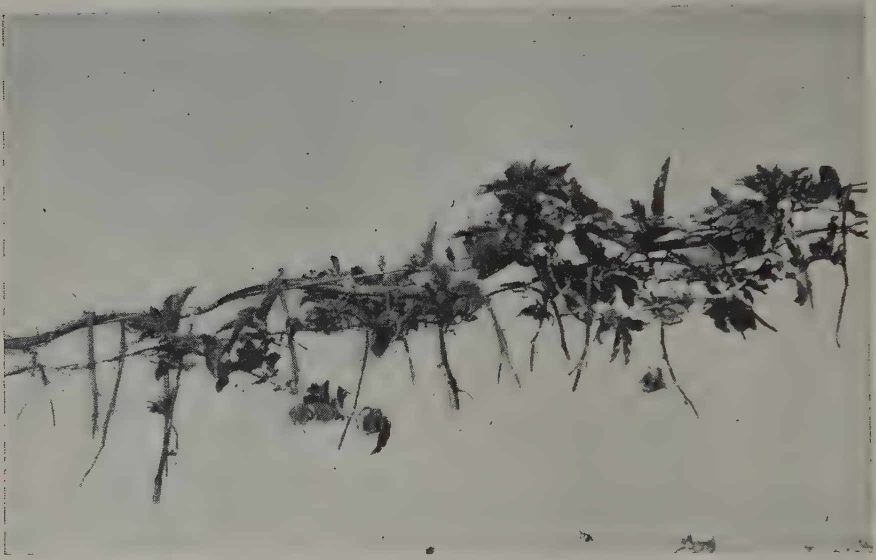


Plate 57.

VINE AFTER PRUNING.—The laterals are cut back to 9 to 12 inches from the leaders on the wires. It is at this stage that deep cultivation is best carried out.

Some growers prefer to give two light prunings each year—one during the winter, and a second about January-February after the main summer crop has been harvested and before flowering for the winter crop commences. Others, in addition to heavy winter pruning, like to give a light pruning following the summer crop. Both modifications give good results, the latter in particular. When conditions are too dry for severe pruning during the winter, the system of two light prunings can be safely adopted.

Light pruning (by which is meant in general the cutting away of up to half the length of the laterals) at any time of the year, provided there is sufficient soil moisture, will cause the vine to put forth new growth and blossom, the development of which regulates the period of production of a crop.

Under ordinary circumstances heavy pruning in the winter will produce a big summer crop and a somewhat smaller winter crop. By shortening back the flowering laterals about October and sacrificing portion of the summer crop, a bigger intermediate crop will be secured, provided, of course, that the weather is not dry. Similarly, by pruning back the flowering laterals for the ordinary winter crop about February, a late winter crop can be secured.

In warm localities the vine puts out vigorous growth much earlier than in exposed and colder areas. The grower is advised to carefully note his own local conditions and prune to suit that particular location.

Replanting.

As the commercially useful life of a passion vine is generally about four years, if a grower wishes to continue, some provision should be made for continuity of production. This may be done by rotation and by replanting.

Under normal vineyard conditions the heaviest crops will be produced when the vines are from two to two and a-half years old, after which they gradually decline in production and quality of the fruit. In order, therefore, to keep up a supply of good quality fruit, new vines should be coming into bearing every two years.

Young seedlings may be planted midway between the older vines, and after the summer crop has been harvested every second vine may be cut out and the new vines trained on the trellis in the vacant spaces. As they come into bearing the remaining older vines should then be replaced in turn by fresh seedlings.

Although this method gives a replanting every two years, and a fairly high grade of fruit is produced, it has the disadvantage of necessitating an increased amount of pruning and spraying, as the young vines become infected with brown spot and woodiness to a much greater degree than if planted out in a fresh area.

By rotation areas can be kept isolated from each other either by distance or natural vegetation. Young seedlings planted out do much better under this system. They are not so much exposed to infection from diseased neighbouring plants, are more vigorous in growth, and produce earlier and heavier yields.

Under rotation extra trellises and more extensive cultivation are necessary. This additional expense is offset, however, by the advantages already mentioned. Under this system, too, the land can be periodically spelled from passion vine growing, and the trellises more easily repaired or replaced as required.

Whatever method is decided on, it must be borne in mind that to obtain the maximum profits from passion fruit growing provision must be made for the setting out of new vines at regular periods to replace the older ones as their production falls in quality and quantity. Experience suggests that a two-year system of replanting or rotation is the most satisfactory. This necessitates the planting out of young vines during the spring of every second year.

A three-year rotation or replanting could be adopted, provided the vines remain healthy, vigorous, and productive. Either rotation or replanting must, however, be done at a shorter period than every four years if quality and quantity production of fruit is to be maintained.

Harvesting and Packing.

Harvesting, packing, and marketing is quite as important as production, and every grower should aim at presenting to buyers well-matured, properly graded, attractively packed fruit. Enhanced prices received for well got-up fruit will justify the time and labour expended on its preparation for market.

Fruit should be gathered daily, preferably in the early morning or late evening, when the fruit is cool; it is then not so likely to arrive on the market in a wrinkled or shrivelled conditon. All dropped fruit should be picked up first, as a couple of hours in the hot sun is sufficient to cause severe scalding and possibly render the fruit unsuitable for packing.

The degree of maturity at which the fruit is picked from the vine is of vital importance, and judgment is required in order to obtain the right colour without the fruit being so far forward that it is likely to wrinkle. Good colour is very desirable, and during the cooler weather the fruit should be picked when it has assumed a deep purple. However, during hot weather fruit should be gathered when just a light purple shade has extended over half to three-quarters of the surface of the fruit.

When harvesting during wet weather allow the fruit to dry off thoroughly before being packed. All fruit should be carefully picked to prevent the skin being damaged. This is best achieved by grasping the fruit in the hand with the thumb and forefinger on the fruit stalk, then with a forward pressure of the thumb and a backward pressure of the forefinger, the fruit will be easily detached at a point where the fruit stalk joins the tendril just above the dead flower.

The picked fruit should be placed—not dropped—into the picking boxes or tins, which should be placed on the ground or slung on the body. These, when filled and until despatched, should be kept as cool as possible and sheltered from strong winds.

Bordeaux spray can be removed by immersing the fruit in a weak solution of hydrochloric acid for one and a-half to two minutes, afterwards washing off with fresh water and being allowed to drain before packing.

Passion fruit forwarded to the fresh fruit market should be packed in half-bushel dump cases, and full instructions for packing the different grades are contained in an illustrated booklet which may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

Fruit intended for factory use need not be packed in cases, but may be forwarded to the canneries in sugar bags or similar containers.

Diseases and Pests.

The passion vine does not usually suffer from any serious attack by insect pests. Spotting of the fruit results from the feeding activities of some minor sucking insects, but little damage is done beyond a slight blemish of the outer skin. As the pulp is not affected, the fruit is not harmed. Fruit flies have been known to attack the fruit in its green stage. The eggs, however, do not mature, but the skin surrounding the puncture becomes hard and detracts somewhat from the appearance of the matured fruit.

Fungus diseases such as brown spot and a virus disease known as woodiness or bullet, to which the passion vine is very susceptible, are the main causes for the premature failure in many vineyards. Powdery spot is a minor fungus disease which attacks the terminal growths and fruit during the cooler months of the year. Its attack is more serious on vines up to eighteen months old, since the proportion of the plant affected is then relatively greater.

Brown spot is the most troublesome disease affecting the vine. It attacks leaves, stem, runners, and fruit, causing considerable damage, and if neglected will result in the death of the vine within two years. Young vines are not so seriously attacked as older ones, as the more open growth admits light and air, and permits most of the affected leaves to fall to the ground, carrying the fungal spores with them.

Woodiness is a serious virus disease, and growers are advised to exercise every care in an effort to prevent its spread.

A pamphlet dealing with the control of passion vine diseases may be obtained on application to the Department of Agriculture and Stock, Brisbane, B. 7.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

FEBRUARY.

Stanthorpe	1st to 3rd
Killarney	9th and 10th
Warwick	13th to 15th
Clifton	21st and 22nd
Allora	28th and 29th

MARCH.

Amiens	3rd
Goombungee	8th
Boonah Bushman's Carnival	25th
Oakey	27th and 28th

APRIL.

Pittsworth	2nd and 3rd
Toowoomba	15th to 18th
Dalby	22nd and 23rd
Kingaroy	30th April and 1st and 2nd May
Tara	30th April and 1st May

MAY.

Yarraman	3rd, 4th, and 6th
Longreach	6th to 8th
Nanango	9th to 11th
Murgon	16th to 18th
Ipswich	21st to 24th
Kalbar	25th
Gympie	30th and 31st and 1st June

JUNE.

Bundaberg	6th to 8th
Blackbutt	7th and 8th
Boonah	12th and 13th
Toogoolawah	28th and 29th

JULY.

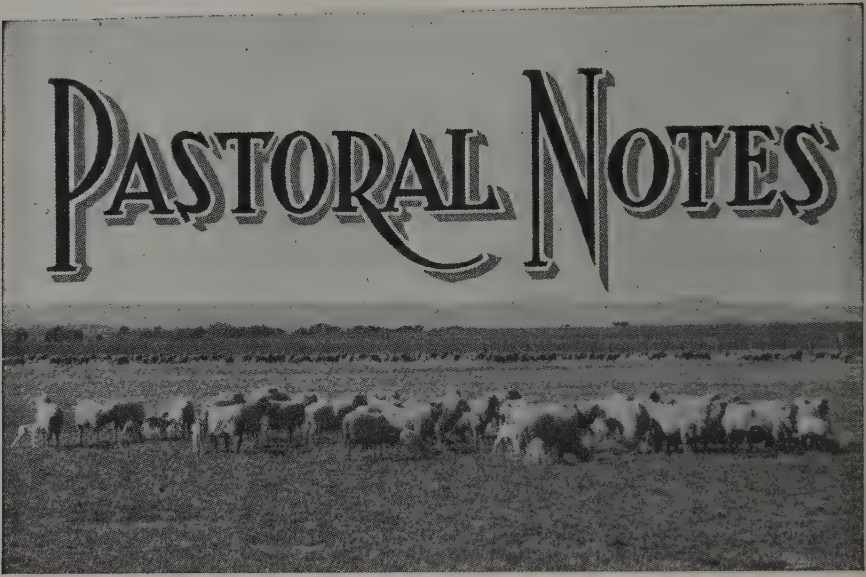
Cleveland	12th and 13th

AUGUST.

Pine Rivers	2nd and 3rd
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

OCTOBER.

Warwick Rodeo	5th and 7th



Yellowwood—Poisonous to Stock.

YELLOWWOOD (*Terminalia oblongata*) is a small tree common in the Central districts of Queensland, particularly about Emerald, the leaves of which have been proved to be poisonous to sheep. The tree should not be confused with the large timber tree found in South-Eastern Queensland, and known by the same name.

The leaves are mostly an inch to one and a-half inches long, and the flowers small and insignificant. The fruit is about an inch long.

Sheep are prone to eat the leaves when these are shed by the tree, as happens in dry weather and, therefore, at a time when other feed is likely to be scarce.

Symptoms Produced.—The leaves are not unpalatable to sheep. Symptoms consist of nervous disorders manifested by ''fits.'' These, however, do not appear until after the sheep have been eating the leaves over a period of several days or even weeks. If the sheep are disturbed, these ''fits'' may be aggravated. The animal is seen to drop down in its tracks as though stunned, and lies trembling and rigid, or the head may be raised and swayed from side to side. The attack may last from a few seconds up to nearly a minute. When on its feet again, it sways unsteadily for a few moments—then moves off to join the flock.

The presence of strangers, or loud noises near the animals, seems to induce the ''fits.''

So far as is known, cattle are not affected, although a peculiar wasting disease of animals in the yellowood areas is possibly associated with the eating of the leaves. This is a subject for further investigation.

Post-mortem.—On post-mortem, the plant is found to have been rolled into hard masses or lumps which tend to block the intestine and set up digestive disturbances, such as impaction. These results have been confirmed in experimental tests. Sheep are usually found dead on the edges of water holes or where they have fallen over the branches of fallen trees, and where they have found difficulty in again rising to their feet.

General.—As with many other poisonous plants, the chemical nature of the poison present in the leaves and responsible for the "fits" is not known. Nothing can, therefore, be recommended for administration to the animal to combat the effects of the poisonous agent. Sheep which have been on the plant for some time suffer a considerable loss of condition and there is also a corresponding loss in wool production.

BLOATING OF CATTLE.

Acute bloating of ruminants, cattle particularly, may occur at any time from a variety of causes, but most commonly through turning hungry cattle on to luxuriant green feed, or on to herbage country, after heavy rains and when the young herbage is making rapid growth.

Under station conditions, where stock are not seen every day, little can be done to prevent loss, but on smaller holdings losses may be minimised if a stack of dry hay is provided and to which stock have access before and after being allowed on to green feed. The long, dry hay assists regurgitation, which is difficult when large quantities of short, succulent feed has been eaten, and, if it is available, animals will always take a few mouthfuls, with beneficial results.

Symptoms of bloating appear quickly. Animals stop feeding and stand still with arched backs, turning their heads frequently to the abdomen, which increases rapidly in size—the swelling becoming most marked on the left side. As the abdomen enlarges, breathing becomes more and more difficult. In very acute cases the nostrils dilate, the animal stretches out its tongue, bellows, and finally staggers and dies in convulsions.

In less acute cases the development of gas is slower, and frequent belching and vomiting prevents its excessive accumulation. In these cases the use of a gag made from a stick about 8 inches long and 2 inches in diameter, with holes at each end through which a thin rope is run to form a rough bridle—the stick being smeared with tar or grease before being put into the mouth—is of value, as it facilitates belching.

Massage of both flanks, applying moderate pressure with both fists upwards and downwards—particularly over the whole of the left flank—while the animal stands with its head uphill, is also beneficial.

Puncture of the rumen with a trocar and canula saves many valuable animals. The instrument must be sterilised by boiling for ten minutes before use. It is wise to keep it ready, wrapped in a sterile towel. The trocar, with its protecting tube, is pushed into the most prominent point of the left flank, usually midway between the point of the hip and the middle of the last rib. Holding the instrument in the left hand, a sharp blow with the palm of the right hand causes it to penetrate the skin, abdominal wall, and the rumen.

The point of the trocar is directed towards the right elbow.

The trocar is withdrawn gradually from its sheath, allowing the gas to escape slowly, giving immediate relief to the animal.

When gas ceases to escape, a cork may be used to close the canula, which is left in position and secured by a clean bandage tied over it and round the body of the animal. Any further accumulation of gas is allowed to escape slowly by removing the cork. When no longer required the canula is withdrawn, and the small puncture dressed with tincture of iodine.

STRANGLES.

Strangles in horses is so called because one of the chief symptoms is a swelling of the glands of the throat, thereby causing strangling or interference with swallowing and breathing. It is an exceedingly contagious disease.

In addition to the swellings of the throat, there is usually a dirty discharge from the nose and sometimes the mouth, with occasionally a severe cough.

There is nearly always fever and loss of appetite, the latter due mostly to difficulty in swallowing.

The swellings develop into abscesses which contain pus, and these may or may not burst naturally and discharge their contents, in which case the patient usually improves.

The cause of the disease are small bacteria which are very easily spread from one animal to another by means of water and feeding troughs, bedding, harness, hands of attendants, &c., as well as by direct contact.

In attempting to treat the disease, particular attention must be paid to the isolation of all affected animals, and great care must be taken that none of the sources of infection mentioned is allowed to contribute to the contagion.

Inoculation of all the in-contact horses with a vaccine has definitely proved of value in preventing the disease.

Treatment of affected horses consists in painting the swellings with strong tincture of iodine once daily for three days in order to bring them to a head, and then opening them by surgical methods and keeping them well syringed out. Inhalations of medicated steam are used for relieving the congestion of the air passages.

Drugs such as potassium nitrate (salt petre) and potassium chlorate may be added to the drinking water, and an electuary of green extract of belladonna is frequently given. In bad cases the use of the new sulfanilamide preparations has proved of great value.

It must not be lost sight of, also, that although strangles most commonly occurs in young horses (yearlings and two-year-olds) it may occur in any age from foals to aged horses, and atypical cases are by no means rare where abscesses occur in all parts of the body, notably the chest and limbs, with or without an affection of the throat.

SCRUB FEEDING OF SHEEP.

In the case quoted it will be noted that the amounts given total 19 cwt. 102 lb., which is 10 lb. under the ton. It is, of course, too much to expect that a grade formula consisting of round figures will give quantities that exactly total a ton. The separate amounts of ingredients should therefore be ''rounded off''—in this case by adding, say, 3 lb. each to the sulphate of ammonia and sulphate of potash, and 4 lb. to the superphosphate.

In conclusion, it might be well to point out that only a certain number of grade formulæ will be found to total anywhere near the ton with the ingredients available; obviously, a 2-10-2 would amount to only a portion of the ton while a 10-10-10 would amount to far more than the ton; consequently, neither of these grade formulae—or other ''extreme'' formulæ—can be found on the market in Queensland.

Edible shrubs and trees which are useful as a supplementary ration for sheep cover a large area of Queensland. Methods of feeding vary according to the class of edible bushes available. Stock owners accustomed to scrub feeding make full use of the varieties available and proportion the day's supply to vary the feeding to best advantage. Although some of the shrubs and trees are not relished under normal conditions, the intensity of a drought gradually reduces the sheep to starvation point, and it is then that whatever top feed is on the property should be made full use of. The system of making this available to the sheep varies according to the habit of growth, but there are few now who destroy the tree to feed the sheep. Lopping is the usual practice.

The digestibility of many of the edible varieties of vegetation leaves much to be desired; consequently they are very poor substitutes for grasses and herbage. When the stage is reached at which the sheep begin to lose condition, and before they fall away to any appreciable degree, scrub feeding should commence. At first the sheep are not inclined to eat much, and then only the most palatable portions. Very little need be provided at the start, and this should consist of a large proportion of the best available. As the sheep take to it, increase the supply, and gradually lessen the percentage of the most palatable until a well-based scrub ration is provided in keeping with the varieties available on the property. If sheep have to be scrub fed for a lengthy period, they are likely to develop digestive disorders, but this is influenced by the nature of the shrubs or trees they feed on. Some varieties will carry them on for many months without showing any ill effects on their condition, but a good lick should be of considerable help in retaining their normal health and condition, no matter what class of vegetation they are fed on. The water to which they have access should be the first point for consideration before preparing a lick, for during very dry weather sheep will drink much more water than they do when juicy food is available.

If the water is slightly salty, say 30 grains to the gallon, it can be considered normal, but if over that amount the salt in a lick may be reduced until the total reaches 250 grains to the gallon, when no salt is needed. Salt alone is not the only ingredient required in a lick as many other minerals, the chief of which are lime and phosphoric acid, are equally essential.

Analyses of most of our trees and shrubs show rather a low and an uneven mineral content, the lime being fairly well supplied, but they lack in phosphoric acid. Analyses also show rather high carbohydrate and usually a low available protein content. It may, therefore, be assumed that a lick should be based on the salt content of the water available and carry protein, phosphoric acid, and lime. A sterilised bone meal carries these three ingredients; it is recommended as the base of the lick, say 60 parts. Other ingredients are salt, 30 parts; Epsom or Glauber salts, 5 parts; and molasses, 5 parts. As the protein content of bonemeal is low, this ingredient can be added by using meals —such as cotton seed, peanut, wheat, linseed, or other such meal—all of which supply a most important want. Blood and meat meal, however, carry a greater protein content and may be used to advantage in supplying this element in a lick. Neither is attractive to sheep however, therefore any mixture supplied should carry an ingredient to induce the sheep to take to it. If salt is lacking in the water, it may be used to advantage in inducing sheep to take the desired amount of mixed lick. In the absence of salt, cotton seed or similar meals are attractive, and the intake of lick regulated to about ½ oz. per head per day through their use. The action of a good lick is to stimulate the digestive organs and so whet the appetite as to cause the sheep to eat more and, at the same time, make better use of the food consumed—a decided advantage when scrub feeding.

Practically all our Western timbered country carries a proportion of useful edible shrubs and trees, which include a wide range of varieties (too numerous to mention here) growing over large belts of country. Too much value cannot be placed on the useful fodder trees of the West, and when scrub feeding becomes necessary every effort should be made to preserve them.

CULLING THE EWE FLOCK.

No operation on the property, as a part of general management, is of more importance than the systematic culling of the ewe flock.

All work on a grazing place has for its object, as a matter of course, the making of money. Judged from this point alone, culling definitely pays. It costs no more to feed a profitable sheep than a waster.

From another point of view, the opinion is ventured that 2,000 well-bred and well-fed sheep give a greater return than 3,000 indifferently-bred and half-fed animals. Then, again, the additional space one is able to give the smaller number must come into consideration.

Culling should be done when the fleece has about twelve months' growth, and should apply not only to the ewe flock, but also to the young sheep, especially those which it is intended to keep as future breeders. It is necessary to have fixed a definite type in the mind and consideration should be given to a type suitable to the particular district in which the property is situated, and stick closely to that type.

Any sheep not measuring up to the standard should be rigorously rejected, and this does not apply only to the covering of the animal. Apart from the fleece, some of the common deficiencies which should be taken into account are: Want of size and conformation, body wrinkles denoting the "fly trap" sort of sheep, a leaning towards delicacy of constitution, bad feet and heads, besides many other deficiencies recognised readily by a good classer during the practical operation.

Regular culling leads to the establishment of a good flock, but the full benefit of the practice is not achieved unless better rams are provided for in the policy adopted.

DERMATITIS.

A condition manifested by intense irritation, and development of dropsical swellings, and later death of unpigmented surfaces of an animal's body, sometimes occurs during summer in country where trefoil and St. John's wort grow. It is only on white unpigmented patches of the animal's skin that the condition appears, Pigmented or coloured portions of the skin remain unaffected. Feeding experiments have proved that the ingestion of these plants, together with exposure to strong sunlight, bring about the condition. Cattle so affected show signs of much irritation, biting and licking themselves. Within a few days excoriation of the skin of unpigmented areas occurs. Animals become feverish and lose condition rapidly.

Sheep are affected similarly; the ears and face become thickened and dropsical, and the lips become hard and leathery. If shade is provided, animals seek it readily to obtain relief.

Staining of white patches on cattle with ordinary washing blue is protective. An application of a solution of permanganate of potash made with rainwater to a deep pink colour gives relief.

SORGHUM POISONING ANTIDOTE.

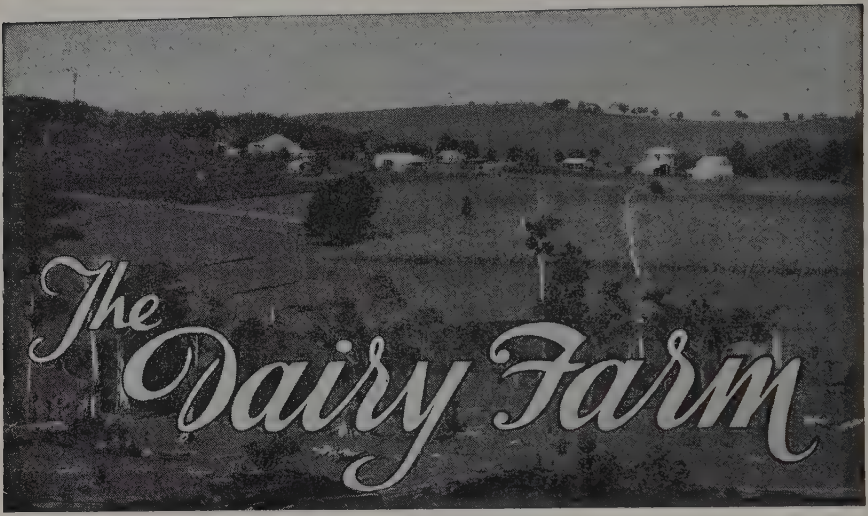
Molasses diluted sufficiently to allow of drenching is regarded as an antidote for sorghum poisoning, a quart being advisable for a cow.

The best antidote, however, is a mixture of solutions of carbonate of soda (washing soda) and sulphate of iron. The procedure is to dissolve 1 oz. of washing soda in 1 pint of water, and, in a separate pint of water, ½ an oz. of sulphate of iron. These ingredients should not be mixed until immediately before application as a drench. Two pints of the mixture are sufficient for a cow, and half a pint for a sheep. If drenching cannot be done, the mixture may be poured into the stomach through a canula inserted as for a bloat, a hand's-breadth forward of the point of the hip bone on the left or near side.

The solutions of each ingredient may be concentrated, but they must be kept separate in glass, coloured preferably, wood or earthenware containers—not iron—and made up with the addition of water to contain 1 oz. of washing soda and ½ oz. of sulphate of iron to the 2 pints of the mixture.

Larger doses of carbonate of soda and sulphate of iron could be given, but it is questionable whether an increased dose would be of any advantage.

Sulphate of iron may be bought for about 3d. per lb., and washing soda for slightly less. A few pounds of each kept on hand for emergencies might obviate a serious loss.



Lubricating the Separator.

BEFORE the separator is used it should be seen that the sight feed lubricator is working satisfactorily. It is absolutely necessary for the machine to receive the correct flow of oil from the lubricator before the separation process begins; otherwise the spindle—one of the most expensive parts of the machine—will show signs of wear long before it is due. Ten drops of oil a minute is a satisfactory adjustment to make on the lubricator. Any increase in this number of drops will not help in the lubrication, although the oil will not go to waste, for it drops into the reservoir at the bottom of the machine.

As soon as separating is finished, the lubricator should be shut off to prevent any more oil from dropping into the machine.

It is advisable to form a habit of cleaning the working parts—the parts that have to be oiled—at the beginning of every month. Take the back cover off the machine, drain out the oil, put in a cup of kerosene or petrol and give the machine a good turn, so that all the moving parts will be thoroughly cleansed. Drain off the kerosene or petrol in the same way as the oil, then replace it with clean, fresh oil, turn the machine again, so as to distribute the oil over the parts, then stop the machine and drain again. This will leave the separator in a thoroughly clean condition, ready to receive fresh oil that will give 100 per cent. lubrication.

Another important point to remember about separator lubrication is that the particular type of oil used must be suitable for high-speed lubrication. Cheap, thick oil should not be used, as it may reduce very considerably the efficiency of the separator.

The whole of the cleaning-out and renewing of the oil can be done well within half an hour, and the time spent will be more than repaid.

THE SEPARATOR FLOAT.

Probably the most neglected part of the separator is the float, the function of which is to regulate the flow of milk into the bowl.

This means that it should be perfectly balanced, otherwise an irregular flow occurs and inefficient separation and fluctuation of tests result.

It has been frequently found that floats are badly dented or leaking. To this condition is added the danger of throwing the float out of balance by unskilful repairs. It has also been found that leaking floats have been repaired without first emptying them, which makes them heavier than designed.

Probably the most serious aspect of damaged floats is the fact that cracks and badly soldered joints provide just the right conditions for the growth of bacteria. Consequently, milk passing over them becomes contaminated, resulting in many cases of cream being graded down.

Dairymen would be well advised to give consideration to this matter, and when repairs are necessary to have them done by a competent tradesman, who should be advised of the importance of the work.

BLOOD MEAL FOR DAIRY STOCK.

Blood meal feeding to dairy cattle presents little difficulty when the meal is fresh and free from objectionable odour. It may be incorporated in the regular feed or mixed with appetising food such as maizemeal, bran, pollard, cotton seed. Care must be exercised, however, to see that the feed box is kept clean.

In the presence of moisture, blood soon fouls and an objectionable smell results from the fermentation. Stock dislike this intensely and considerable difficulty may be experienced in getting animals into the bail where such food has lain.

PROTEIN AND MEAT MEAL.

Protein meal is a meat meal prepared from the clean edible portions of viscera of animals slaughtered, inspected, and passed for human consumption, together with carcases which have been rejected because of some fault rendering the carcase unsuitable for human food. The carcases of immature calves are also utilised for purposes of stock food manufacture. In process of manufacture of protein meal, a soft bone meal is added to the meat to assist in more complete treatment of the meal when passing through the grinding and sieving machinery. The whole mixture is then subjected to cooking at 60 lb. steam pressure for 4 to 6 hours, the time varying with the assortment of the charge (i.e., the mixture). Further heat treatment is then required to render the fat highly mobile for purposes of separation from the crackling (or remaining fatty fibrous matter). This treatment alone is sufficient to render the finished article sterile and free of risk from a disease point of view, hence protein meal is quite a safe product to use.

Meat Meal is a stock food prepared in a similar manner to protein meal, but the raw products consist entirely of livers and lungs from animals slaughtered and passed for human consumption. The carcases or viscera of animals condemned for tuberculosis are not used in the manufacture of protein meal, meat meal, or any other edible line, and hence there need be no fear of transmitting disease through use of these meals; but it is essential in storing them to keep them in a dry place where there is a strong draught of air for this maintains the condition and prevents formation of mould and of objectionable odours.

PROFITABLE DAIRYING.

The first essential is to have every cow in the herd tested to make certain that she is worth keeping. As the animals must be adequately and properly fed, the next important factor is that governing production.

A good water supply is necessary. An ideal condition is, of course, sufficient water at convenient points in every paddock. Many dairy farmers, however, are satisfied with at least one good watering place. That means that if the herd is feeding at a distance from the water the cows do not go to the trough to drink as frequently as they would if it were closer to their grazing ground. On hot days it takes quite a lot out of animals to walk any distance, and when they do come in to water they stay in its vicinity. As the area surrounding the water is usually bare from over-grazing, they get very little to eat. So, in either case, the milk flow is seriously affected.

Another point which is often overlooked is the destruction of grass and herbage caused by the extra tramping of the animals going to and fro. Cows frequently destroy more feed with their feet than they actually eat.

Subdivision of paddocks will provide succulent pastures carrying a full complement of proteins, which the cattle relish and clean up as they proceed without tramping half of it into the ground. With pastures under complete control, the herbage and grasses can be fed off as required; and, in times of plenty, all surplus growths may be mown and conserved either as hay or ensilage.

CONCENTRATES AND LICKS FOR DAIRY CATTLE IN WINTER.

Stock licks are necessary in many districts throughout the year. However, licks plus dry grazing will not be sufficient to maintain stock in reasonable condition, because the protein present in such a combination is not sufficient.

The provision of a protein concentrate is essential if condition and production are to be maintained. The actual form in which the concentrate is to be fed will be largely a matter of convenience and cost.

Most farmers are acquainted with the commercial protein concentrates, *e.g.*, linseed meal, cotton seed meal, coconut oil cake, blood meal, and the various nut cakes commonly used for drought feeding of sheep. Advice on the use of these may be obtained from the Department of Agriculture and Stock, Brisbane.

"DON'TS" AND "BUTS" FOR DAIRY FARMERS.

DON'T have the cowshed roof covered with dust and cobwebs;
BUT lime-wash it and brush it down regularly.

DON'T have heaps of manure just outside the cowshed door;
BUT carry it away daily to the paddock.

DON'T wash a whole herd of cows with one bucket of water;
BUT use one bucket of water for every two or three cows.

DON'T use old pieces of bagging for udder cloths;
BUT use clean cloths kept for the purpose.

DON'T leave udder cloths screwed up in damp bundles;
BUT boil them daily and hang them out to dry away from the dust of the yard.

DON'T follow the practice of wet-handed milking;
BUT always milk with clean dry hands.

DON'T milk into kerosene tins or use them for cream, the folds and crevices provide ideal conditions for bacteria;
BUT invest in well-made milk buckets and cream cans.

DON'T commence milking into the bucket immediately;
BUT direct three streams of milk into a separate vessel for rejection. This milk is bacteria laden and contains little fat.

DON'T allow milk and/or cream to stand in or near the milking bails or dusty yards;
BUT remove it immediately to the dairy or milk stand as the case requires.

DON'T use cloths for straining milk. They are too risky;
BUT use a cotton wad type strainer and strain only once.

DON'T use hot water directly on utensils after milking, as it will bake the milk serums on to the metal;
But rinse or soak them first in cold water.

DON'T wipe the utensils with a cloth after washing;
BUT sterilise them by boiling or steaming and allow them to dry without wiping.

DON'T abuse or knock your cows about, for this is one of the chief causes of dirty yards;
BUT treat them kindly—a contented cow will give more and better milk.

DON'T delay the cleansing of any dairy equipment after use;
BUT remember that it is much more difficult once the milk or cream residue has been allowed to harden.

DON'T forget to cool and stir any cream as provided by the Dairy Produce Acts;
BUT persevere and get "*Choice*" grade every time. It can be done.

The PIG FARM

Preparing Pigs for Show.

IN planning the exhibition of pigs at shows several important points must be kept in mind. The exhibitor should study carefully the prize schedule long before he proposes to exhibit, and should aim at having animals entered in the class or classes for which they are most suited.

The award for a class for boar over twelve and under eighteen months, or under two years, is more readily won, other things being equal, with a boar carrying all the age the class will allow than with a younger animal. The prize for sow with littler not more than eight or ten weeks old is more frequently won with a really good sow with a litter eight or ten weeks old than with an equally good sow with a litter eight or ten days old. Size for age is important. In a class for sow twelve months of age, the sow should be fairly forward in her gestation period. A sow not in pig at that age creates suspicion in the mind of the judge, and she does not or should not stand the same chance of winning. Mature animals should be guaranteed breeders. Pigs are judged on a performance basis, as well as on conformation, plus pedigree, plus age.

Selection of Stock.—The possibility of securing premier honours, while depending very largely under present conditions on bodily conformation, colour markings, and freedom from faults, depends also on the time the exhibitor is willing to give to the preparation of his stock, and the businesslike attitude he adopts towards the job. Successful exhibitors spare no effort to ensure having their stock ready at the time of judging. Some animals are good feeders and are contented, others are stubborn and dislike strange surroundings—refusing to eat and losing bloom.

Condition and Management.—Show pigs should not be fattened to excess. This reduces their breeding capabilities. Fat covers a multitude of minor faults which should not be present in prize-winners. If pigs cannot win in medium breeding condition—other things being equal—they should not win at all.

Appearance catches the eye of the judge, whether it be of live pigs or of other exhibits. The animals should be shown in a clean, attractive condition. Warm water, soft soap, a stiff dandy brush, a softer oily brush, and a sharp knife for trimming the hoofs are necessities. Some pigs have overgrown hoofs, which gradually cause the forelegs to become inbent or the hindlegs misshapen. Removal of natural markings and clippings of the hair of pigs is objected to, and may result in disqualification. Clippers are not necessary in the show pig pen. For dressing the hair and softening the skin, a colourless oil should be used. Cocoanut oil is best, but rather expensive. Petroleum jelly is very useful. Some traders sell a special oil for pig dressing. The oil may be applied after washing: the objective is a clean glossy coat of hair on a mellow skin.

Preperation and Exercise.—Avoid selecting animals with definite faults—such as an overgrown tongue, ears torn or damaged, and irregular markings. Bad tempered, snappy animals should not be exhibited.

Train the animals to move about at will and to become used to strangers. Mature animals should be paraded before the judge in order to show off their good points. Bacon and pork pigs and younger classes are not paraded at most shows, but they may be moved about judiciously in their pens.

Agricultural shows provide opportunities for displaying stock for sale that do not present themselves on the farm. Full advantage should be taken of such opportunities.

Finally, the exhibitor should be a good sport—a good loser as well as a good winner.

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POINTS OF A GOOD BOAR.

When selecting a boar the best available should be bought, for during his life he may be the sire of hundreds of pigs, while the sow can only produce a limited number. If the boar is good he will improve the standard of the herd. His selection, therefore, is of very great importance.

The boar should come from a large, thrifty litter, and be obtained from a reliable breeder. He should be a little more on the compact side than the sow, not too chunky or short, but showing full development at every point, and of a strictly masculine type representing the full type of his breed. He must show quality, smoothness, and evenness in every part, have a typical masculine head, with eyes and ears wide apart, the jowl reasonably full and well laid on to the shoulders, which should be smooth and free from wrinkles. He should have a full heart-girth extending well down to the bottom lines, nearly or quite on a level, with as deep a flank as possible. He should possess rather short or medium length legs, with bone of fair size and quality, pasterns short and straight, and the hoofs well set, legs standing square, straight, and well under him. A long, wide and deep ham, and tail well set up are also desirable characteristics.

MAIZE AND PORK QUALITY.

Because of its relatively high fat content and the low melting point of its fat, maize can cause the production of soft fat in pork and bacon.

A sweeping statement is sometimes made that "maize-fed" pigs are soft as compared with pigs which have been fed on wheat or barley. The statement really needs some qualification so far as Queensland pigs are concerned. A large number could be classed as "maize-fed," but they rarely receive sufficient maize to cause soft pork or bacon.

Maize is the most widely grown grain in Queensland, but the pig industry is not dependent on this crop. It is very closely associated with dairying, the pigs being used primarily to consume the milk by-products —separated milk, butter-milk, and whey. Pasture, forage crops, and root crops also form a large part of the diet of pigs on some Queensland farms, and the grains—maize, wheat, and barley—are really only used as supplementary foods.

These points should be borne in mind when reading the advice of some overseas authorities, who state that maize should not constitute more than about 35 per cent. of the grain allowance of pigs. This may be sound advice under English conditions where pigs frequently receive a diet which is about 90 per cent. grain and which usually does not contain milk products, but under Queensland conditions, where the feeding systems are as stated, there appears to be little danger of pigs receiving sufficient maize to depreciate their carcass quality.

Most of the pigs produced in Queensland can be classed as "milk-fed."

CHARCOAL FOR PIGS.

Digestive efficiency in farm animals depends largely on their ability to grind their food well. Thorough mastication is therefore linked with ease of digestion. Some animals may eat food rapidly without ill-effects. Thus the domestic fowl swallows quickly, but it has a remarkable mechanism in the gizzard for grinding the food to a fine state for subsequent digestion and absorption.

The pig is not so well equipped as the fowl to handle rapidly eaten food, yet under most farm conditions fast eating is the rule. The pig can be helped to make better use of its foods in the following ways:—

(i.) By feeding easily digested material;
(ii.) By grinding the less digestible foods;
(iii.) By ensuring the animals sufficient feeding room;
(iv.) By arranging for some open grazing where the animals may eat at their leisure;
(v.) By feeding aids to digestion.

It is the last with which this note is concerned.

Charcoal and coke are extraordinarily cellular in structure and possess a great number of surfaces. At these surfaces rapid digestion of food can take place. By feeding either of them in powdered form, coarse lumps of food become coated with a film possessing an actively digesting surface.

An alternating and cheaper method is to throw coarse charcoal or coke into the pig sty and let the animals grind and eat as they feel inclined.

Registered
Hatcheries

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale	White Leghorns and Australorps
E. J. Blake, Rosewood	Sunnyville	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, North Rockhampton	Gienmore Poultry Farm and Hatchery	White Leghorns and Australorps
J. Cameron, Oxley Central	Cameron's	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
T. G. Crawford, Stratford	Rho-Isled	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros.	White Leghorns
Rev. E. Eckert, Head street, Laidley	Laidley	Australorps, White Leghorns, and Langshans
Elks & Sudlow, Beerwah	Woodlands	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros.	White Leghorns
G. Grice, Loch Lomond	Kiama	White Leghorns
J. W. Grice, Loch Lomond	Quarrington	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & C. E. Gustafson, Tannymorel	Bellevue	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps. and Brown Leghorns
A. Malvine, junr., The Gap, Ashgrove	Alva	White Leghorns and Australorps
H. L. Marshall, Kenmore	Stonehenge	White Leghorns and Australorps
W. J. Martin, Pullenvale	Pennington	Australorps, White Leghorns, and Langshans

Name and Address.	Name of Hatchery.	Breeds Kept.
J. A. Miller, Racecourse road, Charters Towers	Hillview	White Leghorns
F. S. Morrison, Kenmore	Dunglass	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen	White Leghorns and Australorps
D. J. Murphy, Marmor	Ferndale	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
H. K. Roach, Wyandra	Lum Burra	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge	White Leghorns
A. Smith, Beerwah	Endcliffe	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield	White Leghorns
A. J. Teitzel, West street, Aitkenville, Townsville	Teitzel's	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley	Chillowdeane	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's	White Leghorns, Brown Leghorns and Australorps

Following is a list of new registrations received up to the 19th December, 1939:—

J. E. Caspaney, Kalamia Estate, Ayr	Elvington	White Leghorns
T. Duval, Home Hill	Duval's	White Leghorns
F. G. Ellis, Sunny Corner, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
F. McNamara, Vogel road, Brassall, Ipswich	Frammara	White Leghorns and Australorps
C. Mengel, New Lindum road, Wynnum West	Mengel's	Australorps
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	..	White Leghorns and Australorps

THE PURCHASE OF POULTRY.

At this time of the year, the upward trend of egg values tempts many beginners, and also persons who keep a few fowls, to increase their income from poultry by purchasing pullets or hens. The idea is fairly sound, but there are numerous pitfalls for the inexperienced buyer.

Assuming that the beginner sets out to buy pullets about four or five months old, it is only natural to expect that the quoted price will have an important bearing on the transaction. For instance, if pullets four to five months old are obtainable from one source at 6s. per pair and from another at 10s. per pair, the cheaper lot may be bought.

The inexperienced buyer seldom appreciates the necessity for paying the higher price, as the birds are of the same age and breed. It should be borne in mind, however, that there is usually a definite reason for the difference in the price, and that difference can be summed up in one word—quality. The cheaper birds may have been culled from flocks, as the result of their being backward or stunted in growth. Such birds cannot be expected to commence egg-laying at the normal time and be profitable. If they are culls as pullets, it is unwise to breed from any of them. They cannot return a profit, irrespective of the purpose for which they are used.

After allowing for feeding costs and a slight increase in egg values, it is unlikely that the more expensive birds will show any profit during their pullet year. It is quite probable, however, that they will repay their purchase price. At the same time, many of these birds should make suitable breeders and their use for this purpose would be profitable.

Much the same applies in the case of hens. Cheap hens are usually unsuitable as breeders, whereas many breeding birds may be selected from the more expensive birds. The purchase of old hens is not good business, apart from their value as future breeders. Again, while the beginner may be able to distinguish a pullet before it begins laying, once production starts it is more difficult to separate hens which have just completed a moult and pullets which have been laying for a few weeks. It is also very difficult to distinguish between a hen that is fifteen months old and one four years old. This means that in buying alleged first year hens the birds could be any age above that mentioned.

In such circumstances, it is advisable for the prospective buyer to inspect the flock from which it is proposed to make the purchase before parting with his money.

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MARKING EARLY LAYING PULLETS.

The marking of early laying pullets provides a practical method of selection where the trap nest is not used.

Records obtained by trap nesting in various parts of the world show that —

(1) Early laying pullets are, as a rule, the highest producers;

(2) Birds that lay late into the autumn and are late in moulting are also high producers.

As the early layers and late moulters are high producers, a marking system will assist in distinguishing between profitable and unprofitable fowls.

In one convenient system of marking, a coloured leg band is placed on the left shank of all pullets which start to lay before six months of age. A band of another colour is attached to the left shank of pullets starting to lay when six and seven months of age, and a third coloured band is used for fowls which commence to lay in the eighth month. Pullets that do not lay until after the eighth month should be culled from the flock, or kept in a pen by themselves, and forced for egg production.

Pullets which are early layers show the following characteristics:—

(1) A large red comb;

(2) An active disposition and a ravenous appetite;

(3) Roominess between the keel and pelvic bones;

(4) An occasional disappearance of the yellow coloration round the vent in some yellow shanked varieties.

In small flocks, individuals showing the abovementioned characteristics may be caught in the nests and then marked.

During the following season, all fowls which were marked as late maturing the previous autumn and moult in December, January, and February may be culled. All the early laying birds, and those that moult after 1st March may be kept for layers or placed in a special breeding pen and mated to a male known to have come from a high laying hen that has been trap nested. In this way the egg production of the offspring may be raised.

The points outlined provide a simple method of selection which will, properly used, raise the level of production in a flock.

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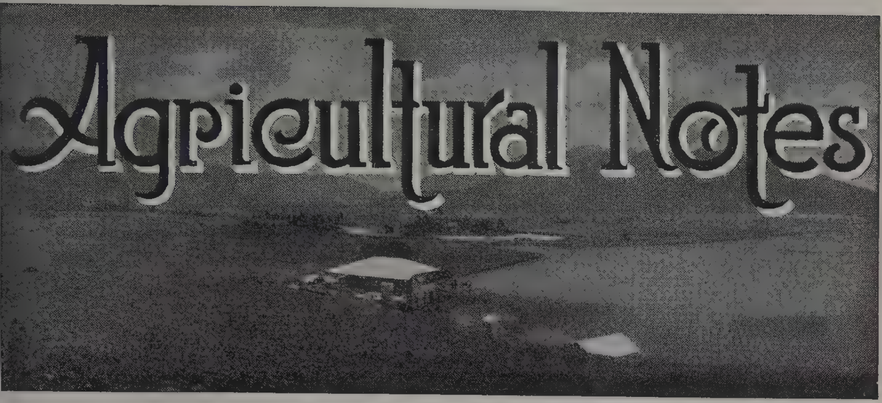
PRIMARY PRODUCTS FOR SECONDARY INDUSTRY.

Much attention is now being given to the study of crops for food and clothing; but, so far, not so much attention has been given by research institutions and industries to the use of farm products in mills and factories making the thousand and one things people need after their backs have been covered and their stomachs filled. The human stomach is of limited capacity, but the ''stomach'' of industry is practically insatiable under normal conditions. So efforts to find ways and means of economically using farm products in making materials for use in all sorts of manufacturing processes will have to be increased. There have been enough results in recent years to indicate great possibilities, but, so far, they had almost no effect on the farmers' market, because, for example, cellulose and other raw materials are produced in such immense quantities in waste products, as well as in crop surpluses, that consumption in industry must be on a vast scale in order to affect the crop market materially. However, it is not only necessary to provide the raw materials of the farm in such form that industry can use them easily, but it is necessary to provide them at reasonable cost to the manufacturer, as well as at a reasonable profit to the producer. Together the engineers and chemists may help to solve these problems by working out new ways of processing farm products, cheaper equipment and methods of production, more efficient storage, and more effective preparatory processing on the farm.



Potatoes in Central Queensland.

IN Central Queensland, the winter crop of potatoes is normally planted between mid February and March, and as the growing season is short, harvesting is usually in full swing by June. Climatic conditions are responsible for the comparatively short period between planting and maturity, and also the smaller yields in comparison with those obtained in more temperate regions.

Trials have disclosed that although the tubers attain normal size, the number per plant in this crop is comparatively low, which suggests that yields could be increased by closer planting. This opinion is confirmed by the successful crops obtained in areas where the seed tubers have been spaced 9 inches to 12 inches apart, instead of the wider 12 inches to 18 inches usually practised in the southern districts. As the yield per plant in the winter crop is apparently not reduced by the closer spacing, this method is valuable where small areas are under cultivation, particularly when irrigation facilities are available.

Fertilizer trials conducted on average soils have not shown any marked increase in yields, but further experimental work is necessary before a definite recommendation can be made. However, crops grown on the poorer soils, particularly of old cultivations, should benefit from substantial applications of phosphoric acid and potassic fertilizers.

As heavy rains are likely to be experienced at this period of the year, well-drained, free-working soils are to be preferred. Deep ploughing will be found to assist drainage, besides providing more favourable growing conditions.

If seed potatoes are purchased from outside sources, preplanting treatment with hot formalin or acid corrosive sublimate may be desirable.

Although cut tubers are permissible for spring planting, seed for the autumn crop should definitely comprise whole tubers only.

Attention is also directed to the control of Irish blight and other diseases by means of suitable sprays, full particulars of which may be obtained on application to the Department of Agriculture and Stock.

ANIMAL MANURE.

The unused dung of farm animals in Queensland must represent a great loss of national wealth each year. On almost every dairy farm one can see this waste from the freshly voided piles round the milking yards to last year's unditurbed cake lying bleached and useless in the field.

Idle dung is not only idle money, it is wasted money. About four-fifths of the food consumed by farm animals is excreted, and the fertilizing constituents of this manure are equal pound for pound to the best obtainable.

The urine soaks into the earth and soon makes its nutrients available to the plant roots, but the dung lies on the surface and if left unbroken may take years to decompose.

The direct results of this condition are readily observed. A definite area is temporarily spoiled for grazing, and when eventually grass grows around or through the heap it is completely ignored by stock until there is nothing else left. By this time the grass has aged, become harsh, and lost much of its nutritive value.

The indirect results are not usually recognised. Rats and other vehicles of disease revel in droppings, and transfer any infection to feed bins, troughs, and stored foods.

These disadvantages can not only be eliminated, but, by using a proper system of conservation and distribution, be converted to profit.

The material which accumulates in sties and stalls or where animals congregate can be readily collected and tipped into a nearby excavation. The excavated earth can be banked to form a run-off. A covering of palings, old posts, sheets of iron or other suitable material should be used to avoid trouble to stock and inconvenience to farm workers. Manure stored and covered in this way loses little of its fertilizing value. Manure piled in the open and exposed to the weather loses much by fermentation and leaching.

When land is to be manured the pit can be opened and the material removed.

Where the paddocks are large and the droppings widely distributed a system of conservation is not practicable. In such cases periodic visits should be made with a rake and the dung under shade trees, around watering places, or along ''pads'' broken up and scattered. This allows the material to dry quickly and continuous tramping by stock soon works it into the soil.

The benefits derived from the farm manure are twofold. It supplies plant nutrients as well as an excellent medium for the production of humus—the organic water conserving colloid of soil.

The daily production of dung per 1,000 lb. live weight is approximately—

Cow	52 lb.
Horse	40 ,,
Pig	50 ,,

This means that on a farm running 35 cows, 4 horses, and 4 sows, there would be a weekly production of 6 tons. If only one-third of this could be collected it represents at least 100 tons of good fertilizer each year.

GIANT SETARIA (GIANT PANICUM).

In the past more or less confusion has arisen in connection with the sale for sowing of so-called panicum seed—*Setaria italica.* Botanically the seed in question is not a panicum, but belongs to the genius Setaria, a common collective name for which is "foxtail millet."

At the present time *Setaria italica* (so-called panicum) may be divided into three main types, viz.:—giant, dwarf, and an admixture of both. The so-called giant panicum offered for sale in Queensland is frequently a mixture of the giant and dwarf varieties. In order to clarify the position, it has been decided that the giant and dwarf varieties shall be respectively called giant setaria and dwarf setaria. To ensure that these products will not lose their identity so far as farmers and others are concerned, they should be referred to in catalogues and other publications as follows:—

Giant Setaria (Giant Panicum), and

Dwarf Setaria (Hungarian Millet).

It may be mentioned that the identification of the giant or dwarf varieties is comparatively simple, and is carried out by the Seed Testing Station, Department of Agriculture and Stock, Brisbane, a period of about 14 days being required for the purpose.

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PARA GRASS FOR DAMP PLACES.

Para grass—known in Queensland also as *Panicum muticum* and giant couch—is grown to a large extent in many tropical and subtropical countries. The grass is a rapidly-growing perennial, spreading by means of thick runners which grow along the ground and root at the joints. Vertical shoots are produced at the joints and reach a height of up to 5 feet. The runners spread very quickly, and the area occupied by the grass rapidly increases in size as the mat of foliage is produced.

Stock are fond of both leaves and succulent stems, but the trampling of animals may injure the runners, and under some conditions it is advisable to cut the grass and feed it green rather than graze it heavily. The feeding value of Para grass is fairly good.

Para grass has proved very useful on our coastal country. In North Queensland it has established a good reputation and is widely grown. It grows best on moist or even swampy land, and a paddock on a wet portion of any coastal farm might well be planted with Para grass to provide a change of diet from paspalum. Heavy frosts cut the grass back rather severely, but recovery in spring is rapid.

Seed of Para grass is usually of poor quality; hence the planting of roots or stem cuttings is the usual method of setting out the grass. These may be planted on ploughed land in furrows or started by mattocking in on the edges of waterholes or damp patches. Roots may be purchased in most of the coastal districts. A small number of cuttings will multiply rapidly in warm, showery weather.

A WARNING AGAINST PLANTING "MISSES" WITH A SECOND VARIETY.

It is not unusual practice for canegrowers in Queensland, after they have planted a field with one variety, to replace setts which have failed to germinate by planting setts of a second, quick-germinating variety. The result, of course, is a mixed stand. While we do not wish to condemn this practice out of hand it is nevertheless important that growers should only follow the practice with a full realisation of the possible ill-effects.

In the first place, it is essential that the variety used for supplies be an approved variety, otherwise both farmer and miller will be liable to heavy penalties for the growing or crushing of a disapproved variety. The fact that the disapproved variety was only used to supply misses would be no defence.

Secondly, a variety which is approved when planted, but which is subsequently disapproved, can only be cropped for three years after the calendar year of planting; it must then be ploughed out. During the past year we have noted several cases in which the second variety used for planting misses, has since been disapproved, the result being that in order to get rid of this variety it has been necessary to plough out the whole field.

Thirdly, there is the question of disease eradication orders. It is possible that the variety used for planting the misses may become diseased and its destruction rendered necessary, but, in order to destroy the scattered stools, the whole field may have to be ploughed out.

If a second variety must be used for the planting of misses it would be wise, therefore, to choose a disease resistant variety which is not likely to become the subject of a disease eradication order or to become a disapproved variety.

A.F.B.

◆

USE OF SALT BAGS AS SEED CONTAINERS.

The use of bags which had previously contained salt for packing seed is attendant with risk unless due precautions are taken.

Salt—particularly crude salt—because chiefly of certain impurities which it contains, absorbs much moisture from the air, especially in humid weather. Both the salt dissolved by this moisture on a bag used previously for holding salt, and the damp conditions caused by the salt, can be deleterious to the keeping qualities of the seed packed in it.

If old salt bags—because of the current shortage—must be used, it is advised that they be *thoroughly soaked* in successive lots of water, and then *completely dried* before use.

A good way of soaking is to fasten the bags below the surface of a flowing stream, if possible, for a few hours; the bags should be "thinned out" sufficiently to allow free access of the water to all parts. It is no use merely soaking the bags in one lot of water, and then spreading them out to dry. The job should be done completely, using several waters if necessary.

Horticultural Notes

Planting Fruit Trees.

IN planting out orchard trees to ensure their being placed exactly in the same position indicated by the marking pegs, a planting board will be found very useful, and is easily made. A board about 4 or 5 feet in length, 4 or 5 inches in width, and 1 inch thick, will serve the purpose readily. A "V" notch is cut in one side at the centre and a similar notch at each end, and the board is ready for use.

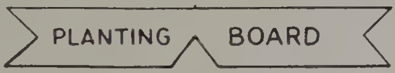


Plate 58.

The centre V is placed agains the peg denoting the position of the tree, and pegs driven in at the notches at both ends of the board. The board and tree pegs are then removed, leaving the two pegs at the ends of the board in position. The hole to receive the tree is then dug. When ready to plant, the board is brought into use again, being fixed as before at the ordinary soil level between the two remaining pegs. The tree is placed in the hole at the centre V in the board, taking the position formerly occupied by the tree peg, and the soil filled in.

The planting board serves another purpose, in that it ensures planting the tree at the proper depth. The correct depth at which to plant the tree is the depth at which it was grown in the nursery; the mark can usually be distinguished on the tree. The union of the stock and scion is always a weak spot in a tree and liable to attack from fungus disease; it should, therefore, be kept above the level of the soil. When using the planting board, the union, if kept level or slightly above the top of the board, will ensure the tree not being planted too deeply.

In digging the holes for the trees, the surface soil should be taken out and kept on one hide, and the subsoil at the bottom of the holes should be finely broken up. Provided the orchard has been properly prepared there is no need to dig deep holes; so long as they are large nough to space the roots without cramping they will serve the purpose. A little top soil may be returned to form a small mound at the bottom of the hole. The roots, which should be carefully washed and trimmed, should be spaced as evenly as possible, and with a downward and outward slope from 40 to 50 degrees. The spaces are filled with fine soil, and pressed firmly, water being applied and allowed to soak in before the hole is completely refilled with soil. Where there is a danger of the trees being scalded by the sun, they should be protected by cylinders of paper tied around the trunks.

The season for planting is determined by location and local circumstances. Where frosts are likely to occur, July or early August planting is preferable to autumn, but where there is no danger of frost injury, autumn planting is satisfactory, as it enables the trees to obtain a roothold before the winter, thereby materially assisting an early spring growth.

THE GROWING OF SUMMER LETTUCE.

While lettuce thrives best in the early spring and autumn, good grade summer lettuce can be produced on the heavy soils of the highlands where the temperature of the air and soil is moderately cool.

Lettuce, particularly at this time of the year, cannot stand a check, therefore an even supply of moisture and plant food must be available.

The preparation of the soil should include the digging in of a generous supply of farmyard manure. Besides supplying the necessary readily available food, this manure greatly assists in the retention of moisture and in keeping the soil cool.

As frequent waterings will be necessary, any extra time required for levelling the land will be well spent.

If the land is dry when the beds are formed, it will be advisable to thoroughly soak them before sowing the seed as it will be found that the beds are inclined to settle unevenly after the first watering.

The seed being very small, should be sown as shallow as possible and covered with just sufficient soil to ensure germination. A top dressing of fine manure after sowing, will greatly assist in the germination, seedling, and maturing stages. Very thick seeding, besides being wasteful, entails much additional work in thinning. Successive sowings should be made at intervals of ten days throughout the summer. The seedlings should be thinned before crowding takes place. Thinning is best done with a light hoe, blocking out the plants to approximately 12 inches apart in the row; further thinning by hand to one plant in any place, may be necessary. To enable the plants to develop deep roots, overwatering at this stage should be avoided. More frequent waterings will be required as the plants increase in size.

Lettuce is a shallow rooter and a poor forager, and, therefore, well regulated waterings will do much to assist the growth of a strong, deep-rooting plant. Over-watering is very damaging, and it will take some experience to tell just when the lettuce needs water. Generally, a tough appearance and a darkening of the leaf are symptoms pointing to a lack of water.

It is very important to select a variety for planting which grows well in the locality under consideration. Climatic conditions and market requirements also should be considered. In this respect, both "Imperial F" and "Iceberg" are recommended.

REPLACEMENT OF CITRUS TREES IN ESTABLISHED ORCHARDS.

Citrus growers who desire to replace unprofitable or decadent trees in established orchards should haul them out and remove all old roots from the soil.

Occasionally, replaced trees do not make satisfactory growth. The poor development of the young trees, however, is usually due to faulty soil preparation. After removing and burning all the old roots the hole should be left open for some time before the new tree is planted. A few weeks before replanting, the soil should be thoroughly cultivated and levelled off. A generous dressing of rotten stable or farmyard manure or some other well-decayed humus-forming material is then mixed with the soil. In frost-free areas, replanting may be done in autumn, but where the frost risk exists, July or August planting is preferable.

Before planting, the roots of the young trees should be trimmed and all broken ends cut off cleanly. The soil should be firmly tramped around the roots. The tree should be set at precisely the same height at which it was growing in the nursery—i.e., with the bud above soil level. After the tree has been set and the soil around it will tramped, but before the hole is completely filled, apply a bucket of water, and when this has soaked in the hole should be filled with loose soil without further tramping.

When the rooting system is established, apply $\frac{3}{4}$ lb. to 1 lb. of sulphate of ammonia to each tree. The fertilizer should be scattered in a circle from 9 inches to 18 inches from the base of the young tree and then raked or chipped into the soil.

BANANA RUST CONTROL.

Banana growers in the area in which rust usually occurs, particularly those on first cut plantations, will be well advised to look out for the first of the new season's rust, which already has been noticed in some localities. In order to ensure clean fruit at maturity it also would be advisable to commence bagging and dusting with a nicotine dust once a fortnight. Full particulars of control methods are available in pamphlet form from the Department of Agriculture and Stock.

In the earliest stages of rust damage, a black smudge will be noticed in between and where two fruits touch, the top hand usually being the one affected most. Numbers of thrips, which are responsible for the damage, will also be observed on the bunch.

Three very important things must be observed if growers expect good results from the control treatment.

1. The bag must be of good quality hessian with a very close weave, similar to that of a sugar bag. Chaff bags and bags with a similar mesh

are too open in the weave for use where rust is bad. On the other hand, potato bags are too coarse and have a tendency to damage the fruit at the tips, through rubbing.

2. The bunch must be bagged as soon as possible after being thrown, preferably before the bracts are shed.

3. The first dusting particularly, and subsequent dustings, must be thorough.

In places where rust is only slight, good quality chaff bags will reduce the damage and otherwise improve the quality of the fruit, but if the damage is severe the good quality hessian bags, plus a fortnightly dusting for from 8 to 12 weeks, are essential.

To ensure treating the bunches as soon as possible after they are thrown, it is advisable to go through the plantation at least once a week. It makes the fortnightly dusting programme much easier if each week's baggings are distinctively marked. For instance, the bags which are placed in February should be marked with a "2" to denote the second month of the year. Underneath the "2" should be marked "1," "2," "3," or "4" to indicate in which week of the month the first dusting was given. When subsequent dustings are given the bunches marked "1" and "3" will be dusted one week and the bunches "2" and "4" in the following week. By marking the bags in this way with the month and week of bagging, the grower also will be greatly assisted in determining the approximate time when a bunch is ready to cut.

LABELLING THE EXPORT APPLE CASE.

With fruit for export, close attention should be given to details in the general "get-up" of fruit labelling.

It is often found when inspecting fruit at the ship's side that labels have not been carefully pasted on the ends of the cases. If the labels have become detached or torn, there is no means of identifying the owner or the trade description of the contents of the case.

Care in applying the labels is therefore necessary. A good paste is made as follows:—

Take 1 lb. flour, ½ oz. alum, and 1 pint water. Mix with a little cold water, then add boiling water until the paste thickens. If the resultant paste is too thin, it should be boiled slowly and a little more flour added with vigorous stirring until the consistency is right.

When applying the labels they should first be soaked for a short time in clean water. The paste is then applied by using a broad brush first to the case end and then to the label. The pasted surfaces are applied to each other, the label and the case being pressed into close contact by rubbing the surface of the label with a damp rag.

The following points should be observed:—

Place the label squarely on the end of the case.

Use rubber stamps for filling in particulars of varieties, &c. Pencil or writing of any description is not permitted.

Apply the rubber stamp squarely in the spaces on the label.

It must not be forgotten that Queensland's overseas consignments compete with the world's best fruit on the United Kingdom and European markets. Quality fruit should not be handicapped by a faulty finish to the case.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

DURING December payable to high prices for all fruits were returned to growers. The advent of the stone fruit crop did not materially affect the prices of other fruits owing no doubt to the shortage of marketable fruit.

Supplies of all stone fruits have been light as a result of frost and hail damage. The quality has been good and a ready demand has continued.

New season apples have made their appearance, but many should have been left on the trees for another month. Growers are strongly advised not to spoil the early market with consignments of apples in too green condition. Probably early prices will be the most payable for apples because of the restricted shipments during the export season.

Pineapples have been in short supply. Many growers are sending this fruit into market in too green condition, resulting in slower sales and a tendency to lower values.

The following were the ruling market prices during the last week of the month of December, 1939:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 4s. 6d. to 6s.; Sixes, 7s. 6d. to 9s.; Sevens, 9s. to 11s. 3d.; Eights and Nines, 12s. 6d. to 14s.

Sydney.—Cavendish: Sixes, 10s. to 13s.; Sevens, 13s. to 16s.; Eights and Nines, 16s. to 18s.

Melbourne.—Cavendish: Sixes, 10s. to 12s.; Sevens, 12s. to 14s.; Eights and Nines, 14s. to 16s.

Adelaide.—Cavendish: Sixes, Sevens, Eights, and Nines, 14s. to 20s.

Lady's Finger, 2d. to 8½d. per dozen.

Sugars, 2d. to 6½d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 2s. to 8s. per dozen, 6s. to 12s. per case; Ripley, 2s. to 4s. per dozen, 9s. to 12s. per case.

Sydney.—Smoothleaf, 12s. to 20s.

Melbourne.—Smoothleaf, 12s. to 20s.

Papaws.

Brisbane.—Yarwun, 3s. to 6s. tropical case; Gunalda, 2s. 6d. to 4s. bushel; Local, 1s. to 3s. 6d. bushel.

Sydney.— 6s. to 15s. tropical case.

Melbourne.—6s. to 10s. tropical case.

Mangoes.

Brisbane.—Commons, 4s. to 7s. bushel; Special Varieties, 9s. to 12s. bushel.

Sydney.—12s. to 15s.

Melbourne.—10s. to 16s.

Passion Fruit.

Brisbane.—Firsts, 6s. to 8s.; Seconds, 4s. to 6s.

Sydney.—7s. to 10s.

Melbourne.—6s. to 10s.

CITRUS FRUITS.

Oranges.

Brisbane.—Imported New South Wales, 12s. to 14s.

Grapefruit.

Melbourne.—Palestine, 36s. (Export Citrus case.)

Lemons.

Brisbane.—Locals, 8s. to 14s.; Gayndah, 16s. to 18s.; Benyenda, 18s. to 23s.; Victorian, 18s. to 24s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Stanthorpe Cookers, 5s. to 15s. All small green apples should not be sent, as they are practically unsaleable. Imported Apples: Yates, 8s. to 16s.; Sturmer, 9s. to 13s.; Democrat, 10s. to 16s.; Granny Smith, 12s. to 18s.

Pears.

Brisbane.—Broom Park, 9s. to 15s.; Winter Cole, 10s. to 18s.; Josephines, 12s. to 17s.

Peaches.

Brisbane.—Local, 1s. to 2s. tray; Stanthorpe, 3s. to 8s.; small fruit hard to sell.

Nectarines.

Brisbane.—5s. to 9s. half-bushel

Plums.

Brisbane.—Wilsons, 8s. to 13s.; Santa Rosa, 6s. to 10s.; Shiro, 5s. to 9s.; Other varieties, 4s. to 9s.

Apricots.

Brisbane.—New South Wales, 6s. to 11s.; Stanthorpe, 4s. to 11s.; Special Large higher.

Cherries.

Brisbane.—8s. to 12s. a tray.

OTHER FRUITS.

Grapes.

Brisbane.—Local White, 4d. to 7d. lb.; Local Black, 9d. to 1s. lb.; Coominya, 18s. case.

Tomatoes.

Brisbane.—Ripe, 1s. to 4s.; Coloured, 3s. to 7s.; Green, 3s. to 6s.

MISCELLANEOUS VEGETABLES, &c.

(Brisbane unless otherwise stated.)

Watermelons.—Small, 1s. 6d. to 4s. 6d. dozen; Large, 6s. to 15s. a dozen.

Rockmelons and Canteloupes.—Brisbane, 2s. to 5s. dozen; Melbourne, 12s. to 16s. tropical case.

Cucumbers.—2s. 6d. to 5s. bushel.

Pumpkins.—Brisbane, 4s. to 5s. bag; Sydney, 7s. to 11s. bag; Melbourne, £10 to £12 per ton.

Marrows.—Brisbane, 6d. to 2s.; Melbourne, 6s. to 8s. case.

Lettuce.—6d. to 2s. dozen.

Cabbages.—Locals, 1s. to 5s. dozen; Stanthorpe, 3s. to 7s.

Beans.—6s. to 10s. sugar bag.

Peas.—5s. to 6s. sugar bag.

Beetroot.—3d. to 1s. 6d. bundle.

Parsnips.—4d. to 1s. 3d. bundle.

Carrots.—3d. to 1s. bundle.

Rhubarb.—6d. to 9d. bundle.

DAMAGE TO CANE SOILS BY ARSENIC.

The use of white arsenic as a means of grub control has been employed in the Giru area for a number of years. While our entomologists have agreed that in certain circumstances a partial control is possible, the practice has been discouraged as being costly and often disappointing. At the same time the possibilities of damage to the soil due to arsenic accumulations have been stressed.

There was brought to our notice recently a case of a farmer who had consistently employed arsenic for this purpose in a field in which the cane now grows only about 12 in. tall and then dies off. Analysis of a sample of soil from the field showed the presence of arsenic at the excessive rate of 600 parts per million of soil. As arsenic is held tenaciously by the soil, in a manner similar to phosphate, it will probably be many years before the excess arsenic has been leached away or rendered inactive.

—*H.W.K., in "The Cane Growers' Quarterly Bulletin."*

PRODUCTION RECORDING.

List of cows and heifers officially tested by Officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society production charts for which were compiled during the month of November, 1939 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		LB.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (STANDARD, 350 LB.).			
Penrhos Elva 2nd	A. Sandilands, Penrhos, Wildash	12,129·29	520·142	Rosenthal Pendant's Prince.
Sunnyside Cissy 16th	P. Moore, West Wooroolin	11,183·05	407·565	Cosey Camp Rupert
Highfields Perfect	J. A. Heading, Highfields, Murgon	9,590·4	403·117	Headlands Red Robin
	SENIOR, 4 YEARS (STANDARD, 330 LB.).			
Sunnyside Mabel 16th	P. Moore, West Wooroolin	9,674·69	386·345	Countess Lad of Cosey Camp
Happy Valley Melba	R. R. Radel, Happy Valley, Coalstoun Lakes	9,012·04	352·381	Burradale Emperor
	SENIOR, 3 YEARS (STABDARD, 290 LB.).			
Penrhos Pansy 3rd	A. Sandilands, Penrhos, Wildash	9,442·94	366·378	Rosenthal Pendant's Prince
	JUNIOR, 2 YEARS (STANDARD, 230 LB.).			
Rosenthal Dove 20th	D. J. Robinson, Robina, Womina	7,249·25	306·346	Rosenthal Peggy's Admiration
Penrhos Evelyn 5th	A. Sandilands, Penrhos, Wildash	7,102·48	305·514	Rosenthal Surprise
Sunnyside Milkmaid 2nd	P. Moore, West Wooroolin	6,206·55	246·622	Sunnyside Moneymaker
	JERSEY.			
	MATURE COW (STANDARD, 350 LB.).			
Dawn of Southport	C. Huey, Ashview, Sabine	6,759·2	363·891	Werribee Twylish Starbright King
	SENIOR, 4 YEARS (STANDARD, 330 LB.)			
Toxteth Fairy	W. C. Dun, Wolvi	5,495·3	374·303	Trinity Knight
	SENIOR, 3 YEARS (STANDARD, 290 LB.).			
College Starbright 4th	Queensland Agricultural High School and College, Lawres	7,361·94	422·428	Belgonia Peggy 9th's Duke
	JUNIOR, 3 YEARS (STANDARD, 270 LB.).			
Bellgarth Vera Belle 2nd	P. Kerlin, Killarney	5,261·0	295·824	Bellgarth Bellboy 2nd
	JUNIOR, 2 YEARS (STANDARD, 230 LB.).			
Cabulcha Noble Girl	J. M. Newman, Caboolture	6,316·95	341·288	Cabulcha Milray's Autocrat
Calton Loranthe	D. R. Hutton, Bellgarth, Cunningham	5,660·82	267·218	Laddie of Calton
Ashview Roseen	C. Huey, Ashview, Sabine	6,259·35	265·452	Martinvale Duke
Oxford Brown Roselyn	E. Burton and Sons, Wanora	4,608·5	256·069	Oxford Peer
Bellgarth Hazel	P. Kerlin, Killarney	3,848·0	237·292	Trecarne Renown
Ashview Marleen	C. Huey, Ashview, Sabine	4,751·1	231·814	Martinville Duke

General Notes

Staff Changes and Appointments.

Mr. C. R. Mulhearn, B.V.Sc., Government Veterinary Surgeon, who has held the appointment of acting director of the Animal Health Station at Oonoonba, has been appointed director of the Station.

Mr. D. J. Doyle, clerk in the Department of Public Works, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. E. C. Powell, Isis Central Mill, Childers, has been appointed an honorary inspector under the Sugar Experiment Stations Act.

Mr. W. A. G. Haylett, inspector of stock, slaughter-houses, and dairies, Department of Agriculture and Stock, Toowoomba, will be attached to the Willowburn bacon factory.

Mr. A. F. Singh, inspector of stock, slaughter-houses, and dairies, Willowburn, will be attached to the Finnie abattoir.

Mr. E. F. Duffy, agent, Banana Industry Protection Act, Dayboro, has been appointed also an inspector under the Diseases in Plants Acts, and will be transferred to Brisbane.

Mr. J. A. Mobbs, inspector, Diseases in Plants Acts, Brisbane, has been appointed also an agent under the Banana Industry Protection Act, and will be attached to Dayboro.

Mr. W. J. Park, inspector of stock, slaughter-houses, and dairies, has been transferred from Biloela to Toowoomba.

Mr. G. W. Edgar, Austinville, has been appointed an honorary protector of fauna and honorary ranger under the Native Plants Protection Act.

Mr. L. D. Carey, staff inspector, has been appointed acting chief inspector of stock and acting chief inspector of slaughter-houses, Department of Agriculture and Stock.

Mr. A. G. Pegler, manager of Dyneover Downs, Eulo, has been appointed an honorary protector under "*The Fauna Protection Act of* 1937," in respect of the sanctuary embracing Dynevor Lakes.

Messrs. S. S. Carrick (Springbrook), O. K. Ostwald (Peachester), and H. D. D. Aird (Tamborine) have been appointed honorary protectors and honorary rangers, respectively, under the Fauna Protection Act and the Native Plants Protection Act.

Messrs. E. M. Bauer, South Molle Island, and E. M. Catherwood, West Molle Island, have been appointed honorary rangers under the Native Plants Protection Act.

Constable L. V. Hosier, Iron Range, Portland Roads, has been appointed also an inspector under the Slaughtering Act.

Mr. H. S. Hunter, Senior Clerk (Marketing), Marketing Branch, Department of Agriculture and Stock, has been appointed Director of Marketing, Brisbane.

Mr. L. Cain, Clerk (Marketing), has been appointer Senior Clerk (Marketing), Marketing Branch, Department of Agriculture and Stock.

Mr. M. L. Cameron, formerly private secretary to the Secretary for Agriculture and Stock, has been appointed Chief Clerk, Chief Office, Department of Agriculture and Stock.

Mr. E. S. Keehn, an inspector under the Diseases in Plants Acts, has been appointed Private Secretary to the Secretary for Agriculture and Stock.

Mr. M. D. O'Donnell, Inspector of Stock and Dairies, will be transferred from Lowood to Toowoomba, and Mr. E. J. Taylor, Inspector of Stock, from the Zillmere bacon factory to Lowd.

Mr. F. Limpus, senior, Keppel Sands, has been appointed an honorary protector of fauna and an honorary ranger under the Native Plants Protection Act.

Milk Supply.

Regulations have been issued under "*The Milk Supply Acv of* 1938" covering the proceedings in relation to the election of representative of producers and wholesale vendors on the Brisbane milk board.

Cotton Board.

An election to fill the vacancy on the Cotton Board, caused by the death of the late Mr. F. A. Kajewski, resulted as follows:—

John Alexander Peach, Ropely East, Gatton	170
Charles Litzow, Vernor	43
Otto Granzien, junr., Mount Beppo, Toogoolawah	37

Mr. Peach will be appointed for the remainder of the term which ends on the 30th December, 1940.

Fruit Marketing Organisation Acts.

An Order in Council has been issued under the Fruit Marketing Organisation Acts giving notice of intention to extend the operation of the provisions of such Acts for a further period of five years from 1st January, 1940, to 31st December, 1944. It is provided in the order that five hundred fruitgrowers may make a request for a ballot on the question of whether or not the Acts should be continued for such period. Such requisition must be lodged on or before 23rd January, 1940.

Regulations relative to the conduct of a ballot of fruitgrowers on the question of the continuance of the Acts for a further five years, should such become necessary, have also been approved.

Wild Life Preservation.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937" declaring the property of Messrs. A. R., L., and S. North at Wivenhoe, Fernvale, and adjoining lands to be a sanctuary. Messrs. A. C. Ditchmen (shire inspector, Esk Shire Council), A. R. and L. North have been appointed honorary protectors of fauna within the sanctuary.

Orders in Council have been issued under the Fauna Protection Act declaring the town of Inglewood and Dynevor Lakes on Dynevor Downs Holding, Eulo, to be sanctuaries for the protection of fauna.

Banana Levy.

The Executive Council has approved of an extension of the banana levy regulation for a further period of two years from 1st January, 1940. This levy has been in force for some years and is controlled by the Committee of Direction of Fruit Marketing.

The Peanut Industry.

By proclamation the Peanut Industry Protection and Preservation Act came into operation on the 18th December, 1939.

Cane Assignments.

Orders in Council have been issued under the Regulation of Sugar Cane Prices Acts covering fresh assignments of lands to sugar mills in Queensland.

Potato Standards.

A Regulation has been issued under "*The Fruit and Vegetables Acts,* 1927 *to* 1935," prescribing grade standards for potatoes. These cover No. 1 and No. 2 grades, seed potato grade, and chat grade. No. 1 grade shall consist of sound potatoes which shall have similar varietal characteristics and a mature skin, reasonably free from decay and damage, and not less than 3 oz. in weight. No. 2 grade potatoes shall comply with those of No. 1 grade except as to maturity of skin and weight. They shall be not less than 1½ oz., but less than 3½ oz. Seed potato grade shall be not less than 1¼ oz. in weight. Chat grade shall consist of potatoes grown in Queensland which comply with the standard of No. 1 grade, except that they shall not have a mature skin and shall be less than 2 oz. in weight.

Potatoes shall be deemed to comply with the standard of a grade if at least 95 per cent. by weight comply with that standard.

Every bag or container shall be clearly stencilled with the name and address of the grower, and the grade and name of the variety, in letters and figures not less than 1½ inches long, and, in the case of seed potatoes, the word "seed" shall be stencilled on every container.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. W. D. Francis, Botanist.

Red Head or Milky Cotton Bush.

W. and McD. (Calliope)—

The specimen is the red head or milky cotton bush (*Asclepias curassavica*), a native of South America. This plant is common as a weed in many parts of coastal Queensland, both north and south. As a rule, it is not very plentiful. Generally, stock avoid it, for it is rare to see it trimmed. It is a poisonous plant which causes gastro-enteritis.

Johnson Grass.

H.C.M. (Colinton)—

The specimen is Johnson grass (*Sorghum halepense*), a common weed of cultivation in most warm-temperate countries. There is no easy way of getting rid of it, and all methods should be aimed at keeping down the leaf-growth by repeated cutting or mowing, as the vigour of the underground runners depends on the presence of the leaves.

Pigs are very fond of the white underground runners, and have been found very useful in keeping the plant in check. Like most members of the sorghum family, however, it contains a prussic-acid-yielding glucoside, and there is always a little danger in allowing pigs to feed in this way.

Sodium chlorate as a spray has been found effective. Two or three sprayings are needed, and it takes five or six months to kill the grass. Following are the experiences of a local farmer, Mr. W. J. McBaron, of Corinda:—

> "The sodium chlorate is non-poisonous, but it has been found that clothing which has been wetted by a solution of it will burn like gunpowder when dry, and it is impossible to put it out. The clothes are safe while they remain wet. One pound of sodium chlorate should be used to 1 gallon of soft water, to which has been added some soap powder, and this spray should be applied when the grass is old and in head. It is necessary that these three conditions should be observed in order to make the spray adhere thoroughly to the leaves. Spraying should be commenced as soon after Christmas as possible. If it is begun earlier than that, the grass will be too vigorous, and if it is started much later, there will not be time to finish the job before all growth is stopped by the winter. The only effects noticeable after this first spraying will be a slight withering of the leaves and a stooling out from the base. This growth must be caught with the second spraying as it comes to head, and, in a few weeks, all the roots will begin to die back, commencing with the points and the destruction of all the eyes along the roots. If the plants are let alone, it will be found that by the spring the parent stool will be dead and all the roots dried up. As a rule, no third spraying will be needed, except for the odd pieces which always are missed. Care must be taken not to overlook any of these, as otherwise all that has been done will be useless. If it is only a small patch on which the Johnson grass is growing, the seed heads should be reaped as soon as they have formed, but, if this is not done, care should be taken not to let any seedling grass get a hold in the following spring. Ordinary cultivation will kill the seedlings, as in the case of other grasses, if dealt with at an early stage."

The chief distinguishing feature between Johnson grass and other sorghums is the long, white, underground runners.

Dog Burr.

L.A.B. (Brisbane)—

The specimen from the Theodore district is *Bassia tricuspis*, sometimes known as Dog Burr. Along with other members of the genus *Bassia*, it is sometimes called prickly saltbush. It is rather a bad burr in many areas, particularly in cleared brigalow country. In spite of its prickly nature, it is generally regarded as one of the best of these bassias as a fodder.

Candle Nut.

D.W. (Kuttabul)—

The specimens are from the candle nut tree (*Aleurites moluccana*). This tree is often cultivated in gardens and parks in Southern Queensland. It is native to the rain forests of North Queensland, the East Indies, and the Pacific Islands. The nuts contain an oil which is inflammable, and they are used in place of candles as a source of illumination in Pacific Islands by the natives.

The nuts are often eaten by human beings without ill-effects, but at times rather severe illness is caused by them. The nuts cannot be recommended for human food.

The tree is ornamental, a rapid grower, and produces a dense shade. The wood is light, pale in colour, and easily worked.

"Turkey Berry."

C.L.M. (Maryborough)—

It was interesting to have the name "Turkey Berry" for *Rivina lævis.* We note your remark that *Senebiera didyma* is one of the worst examples of cream-tainting weeds. The use of the name "carrot" for this plant is unfortunate. *Apium leptophyllum* belongs to the carrot family. *Senebiera didyma* belongs to the cress family. The confusion of common names is very regrettable. In fact, they are so independable, that it is so often necessary to use botanical names.

Hoary Cress—A Serious Pest.

S.V. (Crow's Nest)—

The specimen is hoary cress (*Lepidium draba*). This plant is a very serious pest in cultivation in most warm temperate countries, and has been established in the Southern States for some years past. We have previously received it only once from Queensland, and yours is the first flowering and seeding specimen. It is a very serious weed pest to have become introduced into this State. If the patches are small, digging out, taking care to get rid of the extensive underground stems, is the most satisfactory method of control; or cutting-off continuously, and so exhausting the underground parts.

The plant is a very serious weed in cereal crops in England, and it has there been found that sulphate of ammonia in fairly strong solution (3½ cwt. in 100 gallons of water) has been satisfactory as a means of control. Several sprayings are necessary before the roots are exhausted. Arsenical sprays may be tried, but they have the disadvantage of being very poisonous, and injuring the standing crop.

"Desert Poison Bush."

V.E.D. (Isisford)—

The specimen is desert poison bush or Hartley poison bush, *Gastrolobium grandiflorum.* This is generally regarded as one of the worst poison plants we have. The poisonous principle is an alkaloid. Drying does not affect the properties of the plant. Commonly sheep browse on country infested with this bush without any ill-effects, but the danger is always there. Like many poisonous plants, most trouble is experienced with travelling stock. We have no definite information on the stage at which the plant is most poisonous, and reports concerning it are somewhat conflicting. Some people claim that the young shoots following a burn are the worst, but this may simply be because of the fact that they are more palatable to sheep than at the later stage.

"Never Fail"—A Common Grass.

W.J.L. (Cambooya)—

The specimen of "Never Fail" is *Stipa aristiglumis,* a fairly common grass on the Darling Downs. We have little information about its fodder value, but species of *Stipa* are generally looked on as of rather poor value. In the Southern States the genus is a very large one, and many of them produce a very objectionable spear-head, and are, in fact, the common "spear grass" of South Australia and parts of New South Wales.

Rural Topics

Psycho-Analysis for Cows.

Psycho-analysis has beaten machinery! At least, this is hinted at in all notices recently about a very sensitive Jersey cow. Milked by machine, this spirited animal found life too dull and materialistic to rouse her best feelings—and her best efforts—and so her milk yield was very disappointing. But a very understanding dairy farmer took her in hand, sympathetically studied her little ways and soon helped the timid beast to find herself and, incidentally, fill the bucket. Now her yield is the talk of the neighbourhood.

Makers of milking machines will not have to take this ''rebuff'' lying down. They will have to find some alternative. After all, nothing is impossible to machinery these days, and, apart from the churning out of caressing music—or changing the record—at milking time, it should be possible to devise some means for the cow to have her horoscope and other little diversions produced mechanically. Another job for the agricultural engineer!

Making Swamp Lands Profitable.

Here's a story of a remarkable achievement by a dairy farmer down on the Richmond River, who has converted a low, reed-bearing area into a richly grassed dairy farm, and with it won the pasture championship of the Northern Rivers of New South Wales. His farm, an area of 330 acres, is now carrying 130 milking cows, 33 heifers, 19 calves, and 1 horse—all the result of sowing the right grasses and of careful pasture management.

Having ploughed and sown with a pasture mixture almost every available acre, he finds that maintenance of these pastures is now his chief concern. This he does by frequent grassland harrowing, mowing of tall growth and weeds, and fertilizing once a year with superphosphate and sulphate of ammonia in conjunction with rotational grazing. On his class of country—all low-lying—he has found out by experience that the heavy carrying capacity of the rye grass-cocksfoot-clover pastures can be maintained for at least four or five years. On the average, ninety-three cows are milked throughout the year. Every day, both in summer and winter, the herd is grazed on improved sown pastures for two or three hours. The plant used for the job consists of a tractor, a combined seed drill and fertilizer distributor, two ploughs, three sets of harrows, and a mower. The total purchase price for the whole outfit was £501.

New Plough to Shorten Farmer's Day.

A new mechanical plough has been demonstrated in the United States, for which it is claimed that it will ''revolutionise agriculture'' all over the world. This machine, it is said, will make the horse obsolete.

It is a four-wheeled tractor coupled to a plough and other farm machinery. It has a hydraulic attachment which keeps the blade of the plough automatically at any depth. It has, too, a weight shifting device, enabling the tractor to rear itself up and free itself if the buried blade becomes wedged. The big rubber-tyred wheels are braked separately, so that the tractor can turn quickly.

For the new plough, it is said that it will shorten the farmer's day and help to bring about the new age of mechanical farming which ''could have the important economic effect, if adopted on a world-wide scale, of relieving the pressure of land-hungry nations for greater shares of the earth's surface.''

Blood Meal for Dairy Stock.

Blood meal feeding to dairy cattle presents little difficulty when the meal is fresh and free from objectionable odour. It may be incorporated in the regular feed or mixed with appetising foods, such as maize meal, bran, pollard, and cotton seed. Care should be taken, however, to see that the feed box is kept clean.

When moisture is present, blood soon fouls, and an objectionable odour results from the fermentation. Stock dislike this intensely, and it may be difficult to get animals into the bail where such food has lain.

Farm Work as a Punishment.

Here is an interesting news item from England:—

Charged with stealing oil from a garage, a Northumberland (England) man has been committed to farm labouring in the evenings without pay as punishment.

Another New Way with Whey.

Whey, once a cheese factory product fed exclusively to pigs and fowls, is now regarded as the source of three commercial products—milk sugar; a concentrate rich in protein; and a solution abounding in vitamin G. A new process developed by the United States Bureau of Dairy Industry splits up the whey powder into these three potentially useful commodities.

Of these three constituents, the milk sugar offers the greatest usefulness. Baby foods, confectionery, medicinal preparations, and explosives are products already derived from milk sugar. The cost of extracting the sweetening from the powdered whey, compared with the expense of developing other sugars, is a temporarily discouraging factor. However, by useing the so-called alcoholic extraction method, the chemist who discovered the method of recovering sugar from whey, believes that production may be made cheaper.

It has been found to be practicable to recover from 70 to 75 per cent. of the milk sugar from this cheese by-product. The quality is said to be comparable with the refined milk sugars of commerce. The bitamin G concentrate is potentially valuable as a poultry food, stimulating growth in chickens and the hatchability of eggs. The third product derived from whey powder, a protein-rich concentrate, may be whipped and used as a substitute for egg whites.

Fleets of high-powered motor trucks and highway networks have lessened the distance between farms and centrally situated cheese factories. Formerly, farmers' milk was sent to small cheese factories here and there in a dairying district, and the whey returned to the farm as feed for fowls and pigs. Now, with the small cheese factory vanishing from the rural landscape, and the increased burden of a multiplied whey output on large cheese factories, drying machinery has been installed in the factory plants for converting whey into powder.

In America last year, more than 1,000,000,000 lb. of this by-product was pressing for a market—hence the importance of this new method of recovering milk sugar and other commercial commodities from whey.

Sorghums for Fodder and Grain.

Cultivation for sorghum and fodder and grain production in districts where climatic conditions may be unsuitable for maize is occupying the attention of the Department of Agriculture and Stock.

About six years ago, twenty varieties of grain sorghum were introduced from South Africa, six from the United States, and six from Egypt. They have all been tested out in different parts of the State, and some of them have already proved their capacity to produce good grain yields under conditions which were against the production of maize for grain.

A special agricultural investigator who visited Queensland recently had this to say of the sorghum crops he saw on the Darling Downs and elsewhere:—

"I was much impressed with the uses to which grain sorghums are being put and with their popularity with stockowners. They have proved very satisfactory in low rainfall areas where maize is a risky crop because of faulty grain setting, or to a serious check in growth due to dry weather.

"There are two main reasons why sorghums are beginning to occupy an important place in farm cropping programmes; first, because of the uses to which the crop can be put; and, secondly, to the development of varieties suitable to harvesting with the ordinary wheat header."

The two main uses for grain sorghums are for fat lamb raising and for cattle fattening—especially for topping them off for market. The method of feeding most in use is to turn the stock into the paddock when the grain is ripe. The carrying capacity of these sorghums fed in this way is exceptionally high, and the percentage of waste is apparently very small. They are mostly utilised as feed in the autumn and winter.

Grain sorghums can be grown cheaply, and the fact that they can be harvested with the ordinary header with certain minor adjustments, suggests the draught reserve possibilities of the crop. Yields, of course, vary with conditions, but up to fifty bushels to the acres have been obtained in Queensland. The grain is being increasingly used for feeding dairy cattle, horses, pigs, and poultry.

Ploughing for Victory.

The farmers of war-time Britain are ploughing their way to victory. The British Government realises that returns to farmers must keep in step with production costs. Careful account is being kept of the costs and farmers are not being asked to attempt the impossible.

Food supply is a constant topic between administrators and producers, and that, of course, is of first importance for, after all, food is one of the few things which is of equal interest to each and every citizen.

Not only the big man with the plough, but also the little man with the spade, is asked to get busy on the job of feeding the nation. Last war Britain became a nation of allotment holders, whose contribution to the total food supply was of decisive importance—especially in 1918. Already a nation-wide campaign has been launched in the Old Country to obtain recruits to the ranks of Britain's food producers.

Simple facts are placed straight-forwardly before the people. ''Do you know,'' they are asked, ''that half-a-million more allotments properly worked, will provide potatoes and vegetables that will feed another million men and women and one-and-a-half million children for eight months out of twelve?''

Producers are appealed to dig, cultivate, plant and sow. ''Dig for Victory'' is the motto of everyone with a garden in Great Britain.

Naturally, it is not all easy going and many farmers are faced with the great difficulty of increased commitments. Like the rest of the community, they are only too willing to go to any lengths to serve the country, but simply cannot afford to take big risks from a financial point of view.

The Ministry of Food has fixed maximum prices for many kinds of farm produce at about pre-war levels. Prices for stock foods, too, have been fixed at about the same level. But there has been a rise in the price of some of the things which farmers have to buy—agricultural implements, utensils, and the like, and costs of production, to the farmer, are creeping up.

It will not be long, however, before the full scheme of price control is established. In arriving at the prices to be paid, all such factors which do determine the cost of production will be taken into consideration and farmers' prices will be adjusted in the light of prevailing circumstances.

Some adjustments have already been made in the prices of fat cattle and of eggs. Similar adjustments will be made from time to time for these and other commodities if and when adjustments are necessary.

The big aim is to give every producer a fair and square deal. That is as it should be, for food producers should be the last to be penalised for their patriotism.

Baled Hay or Ensilage?

Down in the south-western districts of the State, and around Moree, below the Border, there is a good deal of talk about the comparative merits of baling hay for fodder and placing it in pits for ensilage. In recent months baling has become a very common practice, but some flock owners say baled hay is unsuitable for sheep.

One grazier in New South Wales, who has about 1,200 tons of silage underground, contends that hay is too dry for sheep, because of the air getting into the bales. He says, further, that ensilage properly made, is definitely preferable, and that his own experience in getting excellent results from feeding breeding ewes with ensilage proves that this form of hand-feeding is better. Baled hay, he adds, has yet to prove itself as a sheep food.

There is plenty of room for argument in those contentions. Still, there is this to be said for ensilage—it is put down when it is in a tender and luscious condition, and, as the air is kept out of it, it remains palatable for a long time. It is like a tin of sardines. Keep the tin shut and the sardines are all right to eat—especially on toast—but make a hole in the tin or open it, and the sardines are useless, in fact dangerous, as food.

Still and all, a good supply of hay, whether in bale or stack, is a jolly fine standby in a dry time.

A Tale of a Cow's Tail.

A cow's tail is valued at a fiver (£5) a foot in a district in the State of Massachusetts in America. When a savage dog bit off 2 feet of tail from a cow, the dairy farmer claimed in court against the owner of the dog and got judgment for fifty dollars. It was certainly a very expensive bite!

New Processes in Wool Economy.

Experiments which may open many new avenues for the absorption of Australian wool and wool by-products are being conducted by the Council for Scientific and Industrial Research.

Although the sale of the whole of the Australian clip will be assured while the war lasts, the results of the Council's investigations may enable the industry to be placed on a sounder economic basis than it has been in recent years.

Work has been proceeding on a new process to prevent shrinkage and "felting" of woollen goods, and tests done in the Commonwealth laboratories have given striking results.

Other experiments have shown that yarns made from wool and treated to prevent shrinkage are more extensible, and have a slightly higher breaking strength than untreated yarns. Treated and untreated yarns also have been tested under oscillating stress, which is the sort of stress materials made from such yarns undergo in every-day wear.

In these tests, treated yarns have always been better than the untreated yarns, resisting two or three times the number of stresses that will tear ordinary yarns.

The production of wool fibre on different areas of the sheep's body is being estimated, and it is hoped that a method may be developed by which both fleece weight and the scoured weight of the fleece of any sheep can be calculated from a small sample.

Investigations have been extended to include the examination of fleece wax, of which 70,000 tons is recovered from the Australian wool clip every year.

It has been discovered that some of the ingredients have unusual chemical characteristics which may give them an economic value. Another by-product known as "suint" is also being closely examined. About 20,000 tons of this substance is produced every year from the clip, and it is believed that it is possible to extract about 10,000 tons of potassium carbonate from it.

Where are the "Walers"?

Ex-Light Horsemen of the old A.I.F. will agree that probably, from a military point of view, there was never a better horse foaled than the old "waler," their companion of the Palestine Campaign.

Australia is said to have lost much of its former glory as a breeder of horses and horsemen. Before the days of the motor car, people who had the money, spent freely on horses of quality, and buyers from India and other Eastern countries bought big drafts of "walers" regularly. With a ready and profitable market available, breeders concentrated on high-class stock.

In 1914, when so many Queenslanders embarked for service overseas with the Australian Light Horse, the horses they took with them were of a high standard, and they proved their stamina and courage in the deserts of Eygpt, Sinai, and Palestine.

It would be a tremendous pity if horsebreeding in Australia were allowed to slump any further.

Some people have suggested that trotters would make good Army horses, but the sooner they forget about that idea the better. Their stamina and courage may be all right, but a trotter or a pacer has only one gait, and one that would be utterly wearisome on a long march—especially if it were a forced march. Place a few trotters in a squadron of Light Horse, and watch the result. At the order "walk march," the squadron moves off, most of the horses walking and the trotters and pacers shuffling along, too fast or too slow. At the "trot" they are not so obviously out of step, but when the order "gallop" snaps out the troops on the galloping horses sit upright in line, but the poor troopers on the trotters have to bend forward in their saddles or else "rise" to the trot.

As for draught horses—good useful farm sorts—we seem to be doing all right as yet. Artillery sorts—horses that would go well in a gun team—are as yet fairly plentiful, so the Army authorities say.

The day of the horse is definitely not done, and the Army will require thousands of remounts and gunners before this war is over. So, obviously, we should not allow ourselves to slip in one of the industries which has made Australia famous wherever there are riders to "prong" the "pig skin." But, all the same, the sooner we take stock of the position and improve our breeding methods—or, rather, return to the old horsebreeding standards—the better for Australia.

The Useful Goat.

A word for the pocket edition of the cow—the goat and its value in mining camps and other places where it is not always possible to keep a cow, and where a goat will thrive.

Many goats have only a short milking period—about four months—and are not heavy producers even when in milk. The best of the nannies in milk breeds will produce for about nine months, and one nanny made a record recently of nearly seven quarts during a nine-months' lactation period. A good milker will give enough for a small family and may be kept on one-sixth to one-eighth the quantity of feed required for one cow.

It costs less to buy a goat than a cow—often goats are given away—and less to keep one. The milk is very wholesome. Goat milk has about the same range in butter fat content as cow milk, and varies in the same way with breeds and individual members of a breed. The fat in goat's milk, however, is in finer divisions, and though the cream does not ''rise,'' it can be separated mechanically.

A Point in Lamb Raising.

In breeding fat lambs, strength of constitution is just as much required in the stock as in breeding a general flock. A sturdy, well-shaped lamb will thrive from the first, while a weakly one will be a useless encumbrance on which good food will be thrown away. It is of the greatest importance that the lamb should continue to thrive from the date of birth until time of sale to the butcher. The farmer should, of all things, avoid an undesirable ram, for such a sire has no type with which to stamp his progeny, cannot be depended on, and will prove in the future, as he has done in the past, a disappointment to the owner.

Orange Pulp as a Stock Food.

Here is an item of news from the *Citrograph* (California) whch will interest the citrus grower who may, at times, be troubled with the problem of making use of surplus oranges. Science workers in California have demonstrated that dried orange pulp has a definite value as a feed for livestock. Because of its bulk it is best suited for the cattle or sheep ration. It is not a balanced feed in itself, and should be mixed with other feeds to add variety to a whole ration and also a considerable proportion of digestible nutrients.

According to digestion trials carried out at the Davis University Farm, dried orange pulp has an average analysis of 6 lb. of digestible protein and 72 lb. of digestible carbohydrates—or a total of 78 lb. of easily digested material in 100 lb. of feed. To put in another way—it takes about 128 lb. of orange pulp to obtain 100 lb. of digestible nutrients. In this respect it compares well with barley, wheat, maize, grain, sorghum, and beet pulp. However, as a stock food, orange pulp has not the same palatability as the grains I have mentioned, so it could not be used to the same extent as other feeds. It was found that the dried pulp could make up to 20 per cent. of the concentrate ration.

Fresh oranges, because of their high water content, are worth about a tenth of the dried product for feeding purposes. Fresh oranges, too, are relished by most livestock, but when fed whole the stock soon learn to extract the juice and reject the rind.

So successful have been the trials that orange meal dryers have been installed in some citrus districts for using up culled oranges and surplus fruit which otherwise would be wasted. The pulp has even been stored in trench silos as winter feed for stock.

It is not suggested that the idea could be practically applied in Queensland, but it is interesting to know that the orange, whether fresh or as dried pulp, has a definite stock-feeding value. It is certainly a fact worth keeping in mind.

Ham and Eggs as a "Chain" Lunch.

Pig and poultry raisers will be interested in a Canadian version of the ''chain letter'' scheme. This time it is a ham and eggs chain. One enthusiast for ham and eggs—naturally he wanted to make a lot of money out of the practical application of his idea—gave a party for six friends, at which ham and eggs was the feature dish. Each guest was pledged in turn to give a similar party for six others within a fortnight. The originator calculated that at the tenth round of such luncheon events a trifling total of over 90,000,000 people would all sit down simultaneously to ham and eggs!

War Time Agriculture.

War has intensified the "Grow more food" campaign in Britain—and that slogan has now become a grim warning. Needless to say, it is being acted on promptly and efficiently. Certainly there are no more interested spectators of the progress of the campaign in the Old Country than the farmers of the Dominions.

To make the campaign a success, the British Government has given complete latitude to county executive committees which are controlling the campaign. These men do not deal merely with acres on paper. Having a first-hand knowledge of local farm lands and conditions, they are not obliged to strangle effort with red tape or put on a strait-jacket of regulations, but are free to insist that, say, wheat should not be planted where they know another crop will do much better.

It is thought, however, that the main crop will be wheat. Under the scheme of the Government, a grant of a premium of £2 an acre is made for the ploughing up of the land that has been under grass for seven years or more. The Minister in charge is himself a practical farmer. Experts in agricultural research also are fully engaged in the campaign, and the farmers have the full backing of scientific knowledge and assistance.

In fact, the whole scheme is thoroughly organised, not only in respect of war-time needs, but also in respect of post-war problems which shall arise inevitably.

Economists, in fact, are to-day compiling a record of reactions to every war-time innovation or modification of methods. Take milk for example. Milk deliveries in London are now restricted to one a day. The opinions of producers, distributors, and customers are being scientifically noted, and the savings weighed against the inconveniences. With every change the same careful noting is proceeding.

Obviously, the idea is to produce at the end of the war a complete picture showing the strains, stresses, evolutions, and damage to the industry during the supreme emergency. Files of vital and relevant facts so sensibly marshalled will be of inestimable value to whatever Government is in power after the war. On it, no doubt, the future of British agricultural policy as a whole will be based and shaped.

A revival in agriculture is expected to mark the immediate post-war period, but whether it will be sustained and developed are points on which experts are likely to argue for a long, long time.

Householders with a patch of garden also have responded to the slogan, "Grow more food." Millions of small home gardens have been extended wherever possible. Vegetables have been planted wherever it is possible for them to grow. And springing up in the most unexpected places are small market garden allotments, tilled by workers living in crowded areas where there is no room for home gardens. Even box gardening is being encouraged and expert advice has been made available to everyone who wants it.

There is no doubt about Britain's will to win.

Citrus Fruits as Fertilizer.

Citrus growers of California are certainly out to get everything they possibly can from their crops. In addition to using surplus and culled fruit as stock feed, either fresh or as meal and pulp, they are turning it into fertilizer—and good fertilizer it makes, too. Near some of the larger packing centres, citrus shredding machines have been placed. Tests have proved the value of the shredded product when returned to the soil in the form of fertilizer. The machines shred the fruit at the rate of five tons an hour. The shredded mass is then carted to the citrus groves and dumped and spread. The whole cost of the operation is said to be no more than the cost of dumping the fruit in the ordinary way.

Here is what the chemists say about shredded citrus fruit as fertilizer:—

> "From the chemical determinations it is clearly evident that the orange waste is of equal value in all respects to dairy manure."

The inventors developed the process after working on the idea that cull fruit could be turned to practical use at small expense, and at the same time eliminate the criticism directed at the dumping of apparently good fruit.

From *The Citrograph* (California).

Farm Notes

FEBRUARY.

A LATE sowing of sorghum will provide succulent fodder during the early winter months, or if not required for immediate use, the crop may be conserved as silage or stover. The saccaline variety is favoured for this purpose, as it will withstand mild frosts, and continue to supply good feed well into the winter.

There is still ample time to sow early maturing millets, Japanese millet, white panicum, or French millet, if additional green fodder is desired, while buckwheat also is suitable, as it will ripen in eight to ten weeks.

In the cooler districts, a first sowing of oats, barley, or wheat for grazing may be made towards the end of the month, but elsewhere March sowings will be early enough.

February is regarded as the best month for planting the late or autumn potato crop, the acreage planted exceeding that of the spring or early crop, because of the increased soil moisture usually available. Plant whole seed, preferably not less than 2 inches in diameter, and treat it with hot formalin or corrosive sublimate in accordance with recommendations issued by the Department of Agriculture and Stock. Farmers who are dissatisfied with their returns, and who do not regularly apply fertilizers, would be well advised to ascertain the increased yields usually resulting from their judicious use.

First sowings may be made of mangolds, swedes, field turnips, and other roots utilised for pig and cattle feed. Crops should be drilled in spaced rows so as to permit of cultivation between the rows, and the thinning of plants to suitable distances apart. Where only small areas are sown, the ''Planet Junior'' type of hand seeder will be found very useful. Because of the importance of increasing the area under lucerne, attention should be given to the adequate preparation of land reserved for late March-May sowings. The semi-permanent nature and value of a lucerne stand certainly warrant the best possible seed-bed, for once the crop is established only light surface cultivation can be given.

In the wheat areas, summer fallows will now be in fair condition, and with the assistance of sheep to keep down weed growth, good tilth can be maintained by using rigid tyne cultivators, spring tooth cultivators, and harrows. Wheatgrowers generally are well aware of the importance of maintaining a good surface mulch.

Maize and other row crops will now be well advanced, so that any cultivation given should be as shallow as possible, consistent with the work of weed destruction.

The harvesting of a variety of crops will occupy much time as the season advances. Too much care cannot be given to the grading, bagging, baling, and generally attractive packing of all products placed on the open market, for inferior grades or poorly packed produce are rarely profitable.

AGRICULTURAL ARITHMETIC.

When any branch of primary industry is unusually profitable a general tendency often develops in the direction of inflating land values. False values often tempt us to buy properties at ridiculous prices, thus starting with an over-load of interest. Over-valued land raises the cost of running a farm in every operation. The arithmetic of profits never varies. It is as constant as the coming of night and day. The man whose land costs him £25 a cow, and whose herd produces 300 lb. of butter-fat a cow, can produce butter-fat at an average land cost of not much more than 1d. a lb., but the man whose land cost him £100 a cow, and whose herd produces only 125 lb. of fat a cow (which is about the Australian average), has to face a land cost of a 1s. ½d. for every lb. of butter he produces.

The man who has paid an uneconomic price for his land, and who has failed to build up an economic level of production per cow, or who has failed in the past to keep the feed up to his cows so that they could produce up to their inherited capacity, now has a great war-time opportunity of correcting his mistakes. The nation's anxieties are the dairy farmers' opportunity—From *The Live Stock Bulletin*.

Orchard Notes

FEBRUARY.

THE COASTAL DISTRICTS.

FEBRUARY in coastal Queensland is frequently a wet month, with plant growth rampant. Where green cropping is not practised it is not always possible to keep weed growth in check by cultivation.

The main crop of smooth-leaf pineapples will be ready for canning, and care should be taken to see that the fruit is sent to market with the least possible delay and in the best possible condition.

Bananas for shipment to the Southern States should on no account be allowed to become over-ripe before the bunches are cut; at the same time, every banana should be well-filled.

Citrus orchards require careful attention, as there is frequently a heavy growth of water shoots, especially in trees which have recently been thinned out, and which must be removed. Citrus trees may be planted now where the land has been properly prepared, and it is also a good time to plant most kinds of tropical fruit trees.

A few late grapes and mangoes will ripen during the month.

Strawberries may be planted towards the end of the month and, if early ripening fruit is desired, care should be taken to select the first runners from the parent plants, as these will fruit quicker than those formed later. The land for strawberries should be well and deeply worked. If available, a good dressing of well-rotted farmyard manure should be given, as well as a complete commercial fertilizer, for strawberries require plently of food and pay well for extra care and attention.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE marketing of later varieties of peaches and plums and of mid-season varieties of apples and pears, as well as of table grapes, will fully occupy the attention of fruitgrowers in the Stanthorpe district, and the advice in these notes for the last two months on handling, grading, packing, and marketing is again given with emphasis.

Extra trouble taken with fruit pays every time. Good fruit, evenly graded and honestly packed, will sell when ungraded and badly packed fruit is a drug on the market.

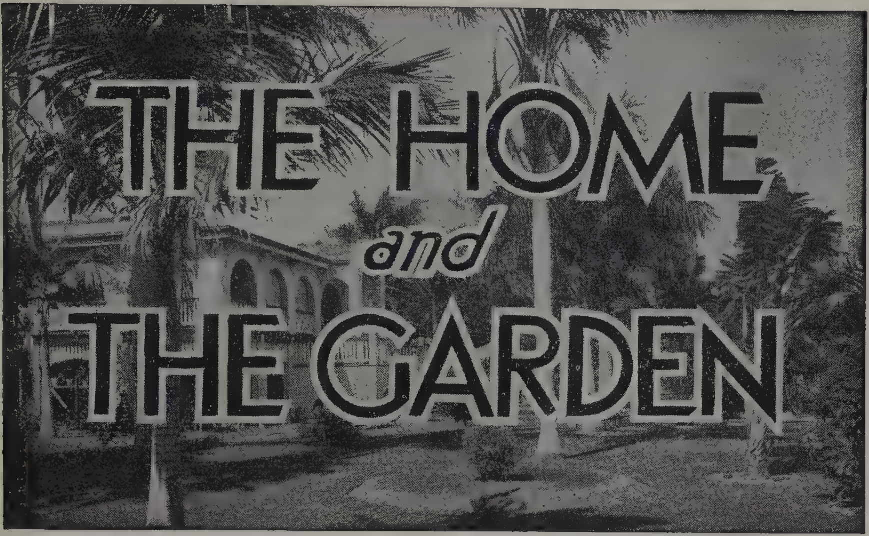
Early in the month it will be necessary to keep a careful watch on the crop of late apples for codling moth. If there is a slightest indication of attack, a further spraying will be necessary, as the fruit that has previously escaped injury is usually that which suffers the most.

Fruit fly also should be systematically fought whenever and wherever found, and no infested fruit should be allowed to lie on the ground.

Grapes will be ready for market, and the greatest care in handling and packing is necessary. Grapes should never be packed wet, and, if possible, it is an excellent plan to let the stems wilt for a day at least before packing. This tends to tighten the hold of the individual berries on the stem and prevent their falling off.

In the western districts, winemaking will be in progress. Here, again, care is necessary, as the better the condition in which the fruit can be brought to the press the better the prospect of producing a high-class wine.

Where necessary and practicable, citrus trees should be given a good irrigation, as this will carry on the fruit until maturity, provided it is followed up by systematic cultivation so as to retain sufficient moisture in the soil.



Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

BABY'S FIRST MONTH.

IN previous articles we have stressed the importance of the care given to the expectant mother, known as ante-natal care. We have recommended her to place herself under the care of a doctor or visit one of the ante-natal clinics, established in connection with the Maternal and Child Welfare Service. We have stated the two main reasons why she should do this—one is for her own comfort and safety, the other for the safety of her expected child.

In this article we assume that the mother has received the care which we have advised, and that she has become the mother of a strong, healthy baby.

IMMEDIATE CARE OF BABY.

As soon as the mother is made comfortable, the baby is washed and dressed. A bandage or binder made of cellular cotton material, rather than flannel, is necessary to keep in position the dressing, which has been applied to the stump of the cord. When this has healed there is no further need for it. The baby should pass urine within the first twenty-four hours. For the first few days the motions are dark green or tarry in appearance. This is a normal condition, and castor oil should not be given.

FEEDING.

Training Necessary.

Most babies know how to suck when they are born. Occasionally we find one who cannot do so, and he will require expert handling and careful training. If baby, who is often very sleepy during the first few days of life, is allowed to be undisturbed, after a day or two he may refuse to suck. There is no more difficult baby to manage than one who has never learned to suck. Feeding him from a bottle will result in further disinclination to take the breast, and make the task of establishing natural feeding harder.

Natural Feeding Best.

It is universally admitted that natural feeding is safest and best for baby. Almost every mother can feed her baby either wholly or partly if she wishes to do so. The smallest amount of breast milk is valuable, because the giving of this helps baby to digest what artificial food he may require. In most cases the supply of breast milk can be increased by proper management, and the aid of a welfare trained nurse should be sought whenever the supply is short.

Baby's progress during the first year depends upon the management and handling which he receives during the first few weeks of life. Baby is put to the breast after the mother has rested, generally in about six hours after his birth, leaving him about two minutes at each breast. Care should be taken to see that he is sucking and not merely dozing. During the first day he is put to the breast once every six hours. On the second day he is fed four hourly and allowed to remain three or four minutes at each breast. On the third day, when the milk supply usually has become established, he is fed three hourly, or four hourly, if he is a strong, vigorous baby, allowing him to feed for fifteen minutes. The average baby feeds from fifteen to twenty minutes, a strong baby may take all he needs in ten minutes. Although the milk does not come into the breasts until about the third day after the child is born, there is present in them from birth a little creamy looking fluid which is very nutritious, and no other food should take its place during these first few days. Sucking stimulates the breasts to secrete and also forms an important part of baby's daily exercise, for not only does it develop his jaws, but it improves the circulation of his whole body.

Feed Regularly.

By educating baby from birth to take his food regularly at stated times, it will be found that he learns to wake when his feed is due, and that he will take all that he needs for his growth and development and to satisfy his hunger during the hours of 6 a.m. and 10 p.m. Some babies will turn night into day and upset the household, unless they are managed carefully. When there is delay in the establishment of breast feeding beyond the third day, feed baby on what milk can be expressed and boiled water.

Avoid Early Artificial Feeding.

Baby should not be given an artificial milk mixture before he is seven days old and adequate efforts to stimulate the flow of breast milk have been made. The supply of breast milk may diminish temporarily when the mother resumes the responsibility of her household duties. Baby may cry as the result of hunger, the mother will be apt to think that her milk is disagreeing, and will be tempted to feed him on an artificial milk mixture.

Visit Child Welfare Centre.

It is at a time like this that a visit to a Maternal and Child Welfare Centre is so helpful. By such a visit, time is saved and mistakes avoided.

When a mother is unable to make a visit, she should write for advice to the nearest centre.

Prevention of Infection.

Avoid exposing baby to infections, such as colds, influenza, whooping cough, measles, &c., particularly when he is young. Visitors are often thoughtless in regard to the danger of infection, forgetting that the infection of even the common cold may have serious consequences when it is conveyed to a baby.

These articles, received from the Maternal and Child Welfare Service, are published each month. The next article will deal with the value of rest and sleep in childhood and the making of baby's bed.

If there is any information a mother requires regarding the feeding, general care, and management of her baby, she is invited to write to the Sister in Charge, Maternal and Child Welfare Centre, Alfred street, Fortitude Valley, N1, Brisbane.

IN THE FARM GARDEN.

TOMATOES ON THE MENU.

Stuffed Tomatoes.

Take 6 firm, ripe tomatoes, salt and pepper, 1 teaspoonful minced onion, soft breadcrumbs, ½ cupful dry breadcrumbs (buttered).

Wash tomatoes, remove stem ends, and scoop out centre pulp, leaving a shell a quarter of an inch thick. Sprinkle with salt. Chop, pulp, and mix with an equal amount of soft breadcrumbs. Add onion, which has been sauted, and season to taste. Fill tomatoes with stuffing and place in a greased baking dish. Sprinkle with buttered crumbs and bake in a moderately hot oven for twenty minutes. Serve with cheese sauce.

Tomato and Sausage Pie.

Take 4 tomatoes, 1 lb. sausages, 1 or 2 parboiled onions, 1 gill stock, 1 lb. mashed potatoes.

Peel the tomatoes by placing them for a minute or two in boiling water, then slice them and put them at the bottom of a greased pie-dish. Season to taste. Lay on the sausages and then the onions, sliced. Add 1 gill of stock. Now pile the mashed potatoes on top and cook in a moderate oven for three-quarters of an hour. Serve hot.

Tomatoes on Toast.

Take 4 tomatoes, 4 rounds of toast, salt, and pepper, 1½ oz. of butter, chopped parsley.

Toast and butter the bread while hot. Slice the tomatoes and place on the toast. Sprinkle with seasoning and chopped parsley and place a small pat of butter on each slice. Grill for five or six minutes. Serve for breakfast with crisp fried bacon.

Tomatoes Scalloped.

Take ½ pint tomato pulp, 2 or 3 tablespoonfuls breadcrumbs, ½ oz. butter, ½ teaspoonful finely-chopped onion, salt and pepper, sugar, nutmeg, browned crumbs and butter.

Obtain the pulp by passing tomatoes through a fine sieve or use preserved pulp. Heat the butter in a saucepan, fry the onion until lightly browned, and add half the tomato pulp and white breadcrumbs gradually until the mixture has the consistency of very thick cream. Add a pinch each of sugar and nutmeg, season to taste with salt and pepper, and pour the mixture into well-buttered scallop shells. Cover lightly with browned breadcrumbs, add two or three small pieces of butter, bake in a moderately hot oven from ten to fifteen minutes, then serve as quickly as possible. This should be sufficient for six or eight shells.

Tomatoes a la Nicoise.

Take ½ lb. cooked salmon (free from skin and bone), ½ gill mayonnaise, ¼ gill of aspic (liquid), 4 even-sized tomatoes, some green salad.

Pound the salmon, add the mayonnaise, season and rub through a sieve, then incorporate the aspic. Cut the tomatoes into quarters, remove the pulp, and re-shape with the prepared puree. Arrange tastefully on a hors d'oeuvre dish upon a bed of finely shredded and seasoned green salad.

Tomato Slices au Gratin.

Take 6 slices tomato, 3 tablespoonfuls finely-grated cheese, 3 streaky rashers, 6 rounds French toast, salt and pepper, parsley.

Cut six thick slices of tomato and warm them through in the oven. To make the French toast, cut rounds of bread the same size as the tomatoes, toast them on one side and butter the untoasted side. Cut the rind from the rashers, fry the bacon until crisp, then chop it into small pieces. Put a slice of tomato on each round of toast, season with salt and pepper, cover each with chopped bacon, and heap grated cheese on top. Place the tomatoes under the hot griller until the cheese is melted and becomes brown. Serve them very hot, garnished with parsley. Sufficient for six slices.

Tomatoes and Mushrooms.

Take 1 lb. tomatoes, ½ lb. mushrooms, 2 oz. grated cheese, 1 oz. butter, 1 oz. flour, ½ pint milk, salt and pepper.

Peel and wash the mushrooms, remove the stalks and slice the tomatoes. Arrange the mushrooms and tomatoes alternately in a fireproof dish. Melt the butter, mix in the flour, and add the milk gradually. Stir till it boils; add nearly all the cheese, and season. Pour the sauce into the dish, and put some slices of tomato and grated cheese on top. Bake in a fairly hot oven for twenty minutes.

Tomatoes Grilled.

Take 4 medium-sized tomatoes, 4 slices hot buttered toast, salt and pepper.

Wash and dry the tomatoes and cut in halves from top to bottom. Make the toast and butter while hot. Put the tomatoes on the tray of the griller and grill slowly until soft without breaking. Sprinkle with salt and pepper. Lift two pieces of tomato on to each slice of toast and garnish with a small sprig of parsley.

Tomato and Rice Savoury.

Take 2 tomatoes, 1 teacupful rice, 1 onion, 2 gills tomato puree, 3 oz. cooked ham, salt and pepper, 2 oz. butter, chopped parsley, dripping.

Wipe the tomatoes and cut into slices. Put them into a baking tin with a little dripping and cook in the oven until tender, being careful to keep the slices whole. Wash the rice and boil it until soft in a saucepan of boiling water with a little salt added—it will take about fifteen minutes—and then strain it. Chop the ham. Peel and chop or grate the onion. Melt the butter in a saucepan and fry the onion in it until tender. Stir in the rice and ham. Season with pepper and salt and mix together. Stir in the tomato puree and make all thoroughly hot, then put into a pie-dish, place the slices of tomato on the top and sprinkle over chopped parsley. Serve very hot.

Tomato Cheese.

Take 5 or 6 tomatoes, 2 oz. cheese, seasoning, breadcrumbs.

Cut the tomatoes into slices and put a layer into a greased pie-dish. Grate the cheese and sprinkle a layer over the tomatoes, then breadcrumbs. Continue with alternate layers until the dish is full, but finish off with breadcrumbs. Bake for half an hour in a quick oven.

Tomatoes and Eggs.

Take 4 tomatoes, 2 eggs, salad, chopped parsley, ½ oz. butter.

Wash, wipe, and cut the tomatoes in halves and scoop out the centre. Melt a little butter in a saucepan and scramble the eggs with the pulp of the tomato and add seasoning to taste. Fill this into the tomatoes; sprinkle some chopped parsley over them. Serve with green salad. Or if preferred fry the tomatoes for a few minutes and serve on fried bread.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF NOVEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Nov.	No. of years' records.	Nov., 1939.	Nov., 1938.
North Coast.	In.		In.	In.
Atherton	2·59	38	5·59	6·82
Cairns	3·87	57	3·53	3·54
Cardwell	4·16	67	4·97	3·52
Cooktown ..	2·52	63	0·56	3·56
Herberton ..	2·65	53	4·35	5·12
Ingham	3·84	47	1·93	5·69
Innisfail	6·37	58	5·55	6·02
Mossman Mill ..	4·56	26	10·16	6·28
Townsville ..	1·90	68	1·36	2·68
Central Coast.				
Ayr	1·76	52	0·52	0·19
Bowen	1·26	68	2·60	0·69
Charters Towers ..	1·46	57	0·18	1·73
Mackay P.O. ..	3·10	68	1·59	2·72
Mackay Sugar Experiment Station	2·84	42	..	5·30
Proserpine ..	2·91	36	0·69	3·13
St. Lawrence ..	2·40	68	2·34	2·40
South Coast.				
Biggenden ..	2·82	40	4·49	5·78
Bundaberg ..	2·74	56	5·41	5·72
Brisbane	3·81	87	2·54	4·76
Caboolture ..	3·64	52	4·18	3·08
Childers	2·81	44	5·25	5·82
Crohamhurst ..	4·64	46	3·02	4·31
Esk	3·31	52	2·41	6·34
South Coast—contd.	In.		In.	In.
Gatton College ..	2·89	40	3·54	5·97
Gayndah	3·01	68	3·41	6·13
Gympie	3·29	69	3·27	3·72
Kilkivan	2·66	60	1·43	6·66
Maryborough ..	3·24	68	2·83	4·21
Nambour	4·27	43	4·09	5·53
Nanango	2·82	57	2·48	5·57
Rockhampton ..	2·46	68	4.66	3·86
Woodford ..	3·31	52	2·07	2·85
Central Highlands.				
Clermont ..	2·07	68	1·94	6·51
Gindie	2·23	40	..	3·26
Springsure ..	2·31	70	2·78	9·19
Darling Downs.				
Dalby	2·90	69	2·05	7·76
Emu Vale ..	2·78	43	1·47	4·75
Hermitage ..	2·58	33	..	..
Jimbour	2·62	51	2·00	4·85
Miles	2·66	54	0·87	3·83
Stanthorpe ..	2·75	66	1·74	3·09
Toowoomba ..	3·34	67	3·93	3·91
Warwick	2·65	74	2·26	4·25
Maranoa.				
Bungeworgorai ..	2·23	25	..	0·75
Roma	2·17	65	1·58	1·18

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—NOVEMBER, 1939.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·87	87	75	90	26	70	13	56	4
Herberton	..	83	61	94	25	55	21	435	11
Rockhampton	29·94	89	68	102	24	61	1, 2	466	7
Brisbane	29·98	81	64	92	29	56	1	254	9
Darling Downs.									
Dalby	29·96	87	59	99	24	47	6, 8	205	9
Stanthorpe	..	78	51	88	24	32	8	174	12
Toowoomba	..	80	56	92	24	42	8	393	11
Mid-Interior.									
Georgetown	29·87	97	71	103	22	64	16	136	5
Longreach	29·89	93	66	108	25	52	8	101	5
Mitchell	29·91	89	62	105	25	42	8	193	8
Western.									
Burketown	29·87	95	74	102	24	61	9	40	2
Boulia	29·84	94	70	109	23	56	8	101	5
Thargomindah ..	29·88	89	65	105	24	53	6	106	5

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

					MOONRISE.	
	January, 1940.		February, 1940.		Jan., 1940.	Feb., 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	5·0	6·50	5·25	6·46	11·9	..
2	5·1	6·50	5·26	6·46	11·50	12·2
3	5·1	6·50	5·27	6·45	a.m.	12·49
4	5·2	6·51	5·27	6·45	12·31	1·40
5	5·3	6·51	5·28	6·44	1·15	2·31
6	5·3	6·51	5·29	6·43	2·2	3·25
7	5·4	6·51	5·29	6·43	2·51	4·15
8	5·5	6·52	5·30	6·42	3·43	5·12
9	5·5	6·52	5·31	6·41	4·37	6·5
10	5·6	6·52	5·32	6·40	5·41	6·54
11	5·7	6·52	5·32	6·39	6·26	7·45
12	5·8	6·51	5·33	6·38	7·17	8·34
13	5·9	6·51	5·34	6·38	8·9	9·26
14	5·10	6·51	5·35	6·37	9·2	10·17
15	5·11	6·51	5·35	6·36	9·47	11·6
						p.m.
16	5·12	6·50	5·36	6·36	10·37	12·3
17	5·13	6·50	5·37	6·35	11·31	12·56
					p.m.	
18	5·13	6·50	5.37	6·34	12·26	1·55
19	5·14	6·50	5·38	6·33	1·18	2·47
20	5·15	6·49	5·39	6·33	2·14	3·42
21	5·16	6·49	5·39	6·32	3·11	4·35
22	5·17	6·49	5·40	6·31	3·45	5·25
23	5·18	6·48	5·41	6·30	5·2	6·12
24	5·19	6·48	5·41	6·29	5·56	6·56
25	5·19	6·48	5·42	6·28	6·49	7·42
26	5·20	6·47	5·43	6·27	7·36	8·26
27	5·21	6·47	5·43	6·26	8·23	9·14
28	5·22	6·47	5·44	6·25	9·6	9·59
29	5·23	6·46	5·45	6·24	9·49	10·47
30	5·24	6·46	..	..	10·30	..
31	5·25	6·46	..	..	11·18	..

Phases of the Moon, Occultations, &c.

2nd Jan.	☾ Last Quarter	2 56 p.m.
9th ,,	● New Moon	11 53 p.m.
18th ,,	☽ First Quarter	4 21 a.m.
25th ,,	○ Full Moon	9 22 a.m.

Apogee, 14th January, at 10 p.m.
Perigee, 26th January, at 9 p.m.

Observers will have found it interesting of late to notice the gradual approach of Mars towards Jupiter. By the 8th the ruddy Planet will pass the great, slowly travelling, Jupiter. About 8 o'clock they will be seen westward of the meridian, Mars setting at 10.58 p.m. and Jupiter a few minutes later.

A conjunction of Venus and the crescent Moon will occur on the 12th, but below the horizon—though in a clear sky the planets shine with a steady light they scintillate in the denser atmosphere near the horizon.

The Moon will accompany Jupiter on the 15th, Mars on the 16th, and Saturn on the 17th. The actual "conjunctions" will take place in daylight.

Mercury rises at 3.45 a.m., 1 hr. 15 min. before the Sun and sets at 5.35 p.m., 1 hr. 15 min. before it on the 1st; on the 15th it rises at 4.22 a.m., 49 min. before the Sun and sets at 6.12 p.m., 39 min. before it.

Venus rises at 7.10 a.m., 2 hr. 10 min. after the Sun and sets at 8.48 p.m., 1 hr. 58 min. after it on the 1st; on the 15th it rises at 7.37 a.m., 2 hr. 26 min. after the Sun and sets at 8.49 p.m., 1 hr. 58 min. after it.

Mars rises at 11.15 a.m. and sets at 11.25 p.m. on the 1st; on the 15th it rises at 10.29 a.m. and sets at 10.35 p.m.

Jupiter rises at 11.15 a.m. and sets at 11.25 p.m. on the 1st; on the 15th it rises at 10 29 a.m. and sets at 10.35 p.m.

Saturn rises at 12.59 p.m. on the 1st and sets at 12.37 a.m. on the 2nd; on the 15th it rises at 12.7 p.m. and sets at 11.41 p.m.

On a clear and moonless night about 9 p.m. on the 9th, the most luminous constellations will be seen from east to north-west. The Southern Cross is rising in the south-east, above it shines Canopus, second in brilliance to Sirius, and Achernar and Fomalhaut of first magnitude light up the western sky, the latter nearest the horizon.

1st Feb.	☾ Last Quarter	12 47 a.m.
8th ,,	● New Moon	5 45 p.m.
16th ,,	☽ First Quarter	10 55 p.m.
23rd ,,	○ Full Moon	7 55 p.m.

Apogee, 11th February, at 12 noon.
Perigee, 24th February, at 8 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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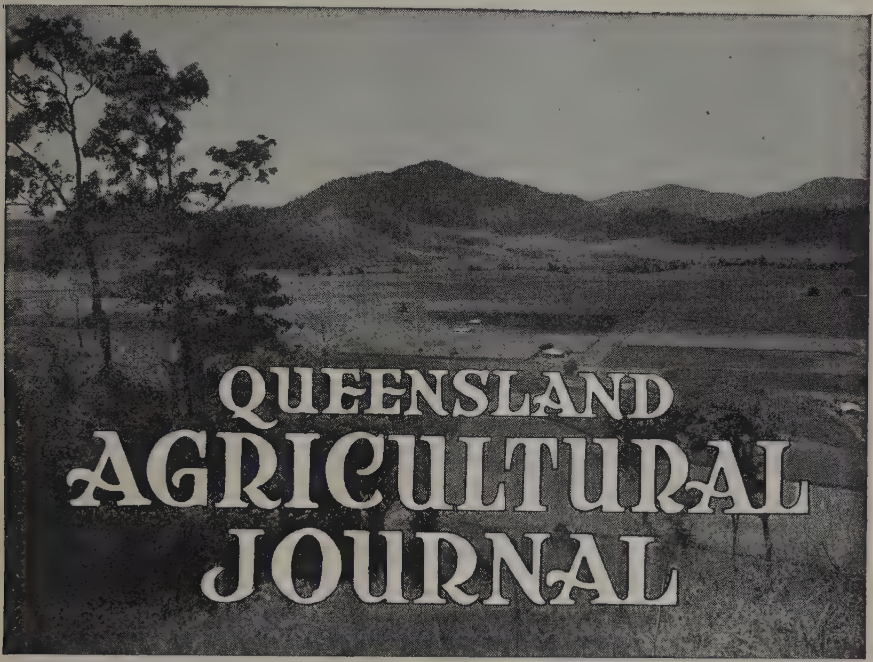

QUEENSLAND AGRICULTURAL JOURNAL

Vol. LIII. 1 FEBRUARY, 1940 Part 2

Event and Comment

Queensland's Outlook.

QUEENSLAND'S outlook for 1940, despite war conditions, is most favourable. That is the opinion expressed by the Premier, Hon. W. Forgan Smith, in a recent Press statement.

We commenced the financial year, he said, with a surplus in the State's funds. Industry generally had enjoyed the biggest returns for many years, and there was more full-time employment at award wages than at any other period in our history.

Queensland also had a greater rate of population growth than the other States, and succeeded in providing employment for the increasing numbers.

This progressive movement coincided with a policy which provided for higher wages, shorter hours, and a lower cost of living than in any of the other States.

Record production, record employment, record national income, and all that these things mean, fortified Queensland to face the future.

The Premier went on to say that the Government had not been carried along on the crest of that movement. It had every justification for claiming that, by a wise direction of major policy, it removed the impediments which had been placed in the way of progressive development, and gave necessary stimulus to industry.

Our great primary industries had a form of control that was the envy of producers in other States.

Our secondary industries had grown up around the needs of those primary industries, and the prosperity of the latter meant the prosperity of both.

Public works generally were brought under a form of control that made for the maximum of public benefit from the money expended.

It was this wide acceptance of organization and co-ordination in Queensland that gave stability to the State's industrial life, and should enable us to face, with comparative equanimity, the periodic economic disturbances over which we have no control.

The financial statement for the half-year ended 31st December, 1939, provided further evidence of the general stability, and Mr. Forgan Smith said he had every reason to believe that the Budget anticipations would be realized.

In view of all the circumstances, we in Queensland could look to the future with the greatest of confidence. There were dismal people who attempted to measure the State's progress with the yardstick of their own personal interests, and frequently their protestations had a volume out of all proportion to their importance. We could not tarry with them when the biggest issues affecting our national welfare called for attention.

The indications were that we should be able to proceed fairly normally with our work, and it was well that we should do so unfalteringly, refusing to be halted by fears of what the morrow may bring.

War Time Marketing.

WITH the impact of war on our economic system, it became necessary to alter our marketing arrangements materially.

Centralized selling became essential, and the central government had the responsibility of bringing it into operation, said the Minister for Agriculture and Stock, Hon. Frank W. Bulcock, in the course of a recent statement to the Press.

Proceeding, he said that an elaborate system of centralized selling was necessary, because economic organisation during times of war was as important as military organization, and with innumerable sellers chaos would result if there were no centralization. Also, without controlled selling, it would be impossible to make shipping arrangements which would fully meet war demands. Fortunately, Queensland's peace-time marketing structure was such that there was little dislocation.

The sugar agreement, and the first sales contract to be effected under it, gave a clear indication of the Government's war-time marketing intentions.

The celerity with which the agreement was concluded, and its effectiveness, were possible only because the sugar industry was completely organized economically. The negotiations were conducted by the Premier (Hon. W. Forgan Smith).

Of considerable importance to Queensland were negotiations for the sale of beef and mutton to the Imperial Government.

Some apprehension existed among growers that the Argentine made a better beef deal, but figures to hand showed that this was not so. There was some variation in individual items, but it was clear that the Argentine average was comparable with that established in Australia under the terms of the agreement.

One regrettable, but unavoidable, feature of the meat agreement was the temporary suspension of the chilled beef trade. All beef had now to be shipped in frozen condition from the Argentine as well as from Australia. Frozen beef was more easily handled, required less loading space, and, unlike chilled beef, could be held for long periods.

Cheese and butter exports were not difficult to arrange because of the existing Commonwealth-wide organization. One satisfactory feature of this particular agreement was that Commonwealth dairy stabilization is preserved.

For eggs, producers had now a stabilized market and a uniform price.

Possibly the biggest war undertaking was in wool. Central appraisement, as an alternative to the auction system, was instituted. Apparently the difficulties associated with the new organization had been largely overcome.

A general review of the wool, beef and mutton, butter, cheese, sugar, and eggs agreements established certain interesting facts.

One was that the policy of those framing the agreements was to avoid profiteering. While price levels under the agreements were, on an average, better than those of the pre-war period, it was evident that there was a determination to prevent undue price inflation.

The producer must have all phases of the cost of production covered, and Mr. Bulcock said he was convinced that the outlook of the producer in Queensland was against taking any unfair price advantage at present.

The second conclusion was that the agreements had a beneficial effect on the community. They had achieved stability.

In pre-war days prices varied from day to day. A producer had to be a prophet to estimate his return. Under the present arrangement he knew what he would receive. Such stability was necessary for agricultural development. One of the ironies of our agricultural endeavours was that in peace time the producer was largely at the mercy of the market, while in war time price stabilization became a constant feature of our agro-economic life.

With a certain and stabilized price production could be planned, regulated, made profitable, and made to serve the needs of our State and Empire. From this arose a question for our economists. How could we best carry through the principles for war-time economy to the days of peace? No doubt this question would be very fully examined.

While satisfactory agreements had been entered into for certain commodities, producers of other products were not so favourably placed. Into this class was placed wheat and canned fruits.

All sorts of difficulties were being experienced in the marketing of wheat, one of the major ones being shipping space.

Speaking generally, however, Mr. Bulcock remarked that Queensland would dispose of all her staple agricultural production satisfactorily. The result would be stabilization in essential industry and a general benefit from increased State income.

The war, he concluded, will open up new avenues of exploration in agricultural economy. Post-war planning, now essential, would envisage, as far as Australia was concerned, a removal of any impediments to increased production. The system of quotas, perhaps, would disappear. At least, it was reasonable that war experience would indicate the necessity for a broadened and expanded Empire market in Britain.

The Parasitic Worm Diseases of Cattle.

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

COMPARATIVELY little is known of the parasitic worm diseases of cattle. This cannot be because cattle are not affected by worms, for even within the confines of our own State, these parasites are responsible for serious losses.

Calves and yearlings suffer most severely, particularly in the dairying districts. These, being practically confined to the coastal watershed, all receive high rainfalls and are associated with a comparatively heavy rate of stocking. Both of these factors are favourable to the infestation of cattle by worms. Furthermore, the methods of calf-rearing adopted by many dairy farmers, whereby the calves are weaned almost from birth and thereafter raised in a most haphazard manner, produces very susceptible animals. Heavy infestations are seen also among young beef cattle, particularly in the coastal areas.

Outbreaks occur chiefly during the winter and the early spring. Infestation, for the most part, takes place during the spring, summer, and early autumn, but so long as the pastures remain green and nutritious, the infested animals usually hold their condition fairly well. As soon as the pastures begin to dry off, however, the animals' resistance to the worms is lowered and ill-effects from the infestations become apparent.

The cattle owner and the dairy farmer in particular, should, therefore, be constantly on his guard against outbreaks of parasitic disease amongst his herds. These are not spectacular in their onset, like the diseases caused by bacteria, for example, and in many cases, the presence of worms is not suspected until the animals are noticeably ill. Mortalities can at times be serious, but even greater losses can follow from the less obvious effects of infestation, such as failure to make normal growth, loss of condition, general unthriftiness, and susceptibility to other diseases.

HOW CATTLE BECOME INFESTED WITH WORMS. (Plate 59.)

Worms do not breed inside an animal and so increase in numbers. The only way in which infestation can occur is through the animal picking up minute larval worms from the pastures as it grazes or drinks. These larval worms arise from eggs laid by female worms living in the animal and passed out in the animal's dung.

With some kinds of worms, flukes and tapeworms, for example, the larval worms after hatching from the eggs must undergo a necessary part of their development in a snail or some other such animal before they can infest cattle. The snail or other animal in which the larva develops is called an intermediate host.

HOW TO DETERMINE WHETHER AN ANIMAL IS SUFFERING FROM WORMS.

An animal whose health is affected by worms manifests certain symptoms, such as unthriftiness, loss of condition, diarrhœa, bleaching of the membranes of the eyes and mouth, the presence of a swelling under the jaws (see Plate 60), &c. Unfortunately, however, none of these symptoms is characteristic of worm infestation alone.

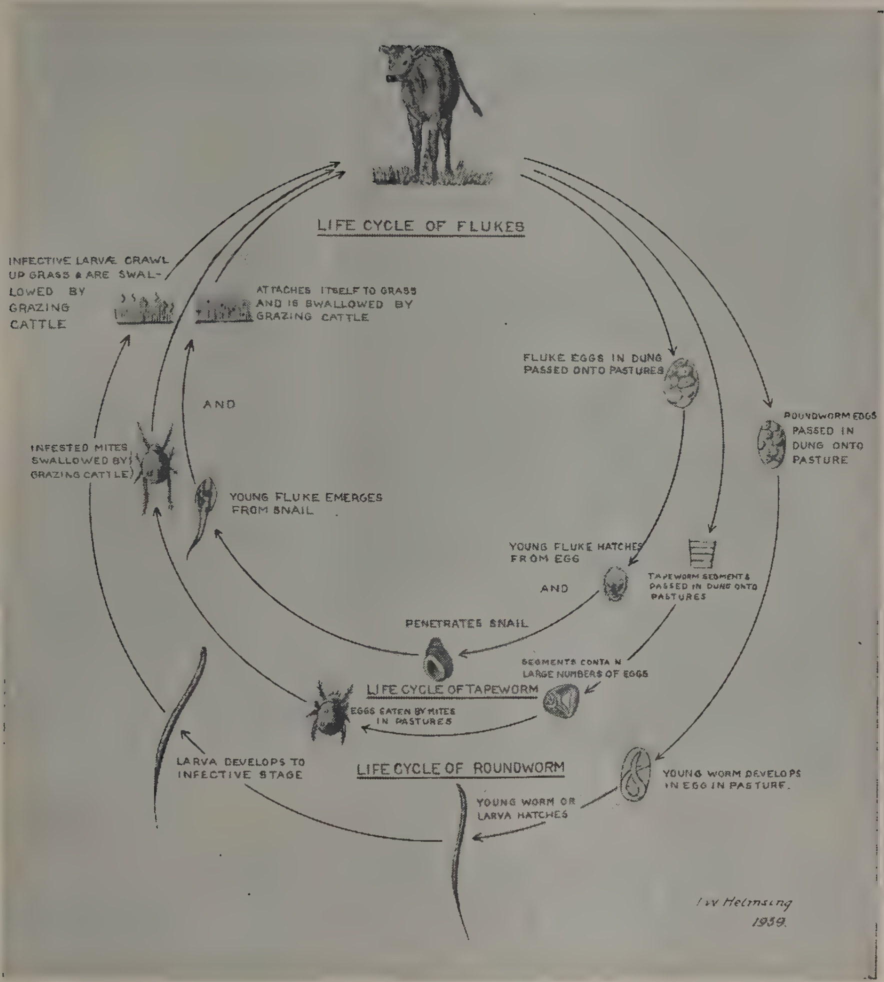
LIFE CYCLE OF FLUKES
INFECTIVE LARVÆ CRAWL UP GRASS & ARE SWALLOWED BY GRAZING CATTLE
ATTACHES ITSELF TO GRASS AND IS SWALLOWED BY GRAZING CATTLE
FLUKE EGGS IN DUNG PASSED ONTO PASTURES
ROUNDWORM EGGS PASSED IN DUNG ONTO PASTURE
AND
INFESTED MITES SWALLOWED BY GRAZING CATTLE
YOUNG FLUKE EMERGES FROM SNAIL
YOUNG FLUKE HATCHES FROM EGG
AND
TAPEWORM SEGMENTS PASSED IN DUNG ONTO PASTURES
PENETRATES SNAIL
SEGMENTS CONTAIN LARGE NUMBERS OF EGGS
LIFE CYCLE OF TAPEWORM
EGGS EATEN BY MITES IN PASTURES
LARVA DEVELOPS TO INFECTIVE STAGE
LIFE CYCLE OF ROUNDWORM
YOUNG WORM DEVELOPS IN EGG IN PASTURE.
YOUNG WORM OR LARVA HATCHES
I. W. Helmsing
1939.

Plate 59.

How Cattle Become Infested with Worms.

1. Permanent pastures.
2. Damp, marshy pastures.
3. Overstocking.
4. Haphazard calf-rearing.
5. Poor nutritive conditions.
6. Unhygienic calf pens and yards.

Any suspicion of infestation in a herd should, then, be confirmed or otherwise by killing and examining an affected animal. There are occasions, however, when this may not be practicable, for instance when the herd is small or when the animals are valuable. It is the only way, however, by which one can make sure that worms are or are not responsible. Young cattle are, for example, susceptible to pneumonia, one type of which is brought about by lungworms. It is only by examining a dead animal that the farmer can make certain whether he should treat the rest of the affected herd for lungworms, or, for example, for calf pneumonia which is associated with bacteria. In making an examination the whole of the alimentary tract should be opened and examined. The lungs should also be given attention and the windpipe and airtubes slit open. It must be remembered that a few worms do little harm, and it is only when they are present in large numbers that they become serious.

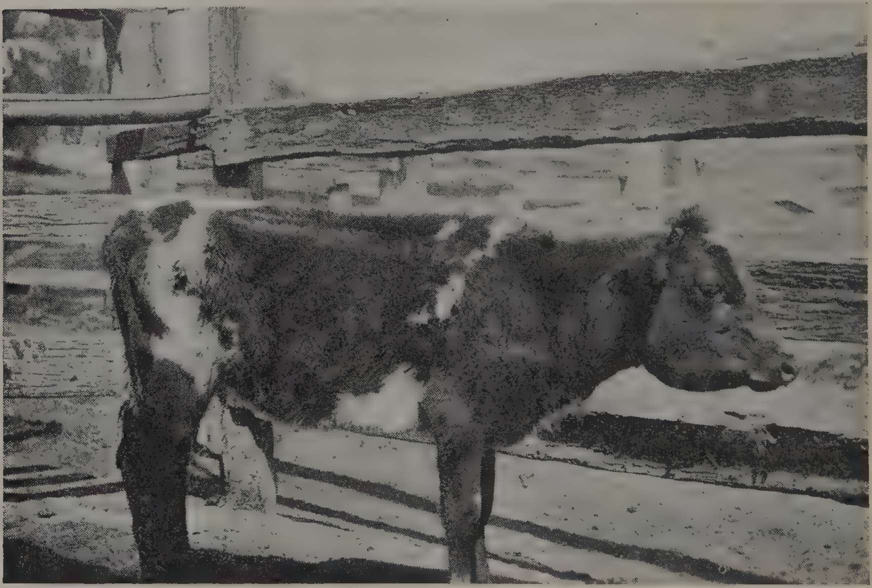

Plate 60.

CALF HEAVILY INFESTED WITH WORMS.—Note its poor condition, rough coat, dull, dejected appearance, and the pronounced swelling under the jaws.

THE CONTROL OF PARASITIC DISEASES.

Under the normal practical conditions of stock raising it is impossible to maintain animals completely free from worms. Much can be done, however, to prevent these parasites from becoming sufficiently numerous to endanger the animals' health. Even when medicinal treatment is efficient it should never be solely relied upon as a means of keeping the infestation at a low level. This applies particularly to cattle, for, unfortunately, very little is known of the efficiency of the drugs that are usually advised for the removal of their worm parasites. The cattle owner must, therefore, realize that in order to keep his stock healthy he should rely chiefly on preventive measures.

Preventive Measures.

Preventive measures are designed to reduce the chances of the animals' becoming infested. They are based upon a knowledge of the life histories of the worms and of the conditions in a pasture which favour the development and survival of worm eggs and larvæ. As calves and yearlings are most susceptible to infestation, these should be given primary consideration when putting the undermentioned principles into operation—

1. Avoid damp, low-lying pastures. Moisture is essential for the development of worm larvæ and also assists greatly in their survival. Such pastures, if it is impracticable to dry them out, should be used only for grown cattle.

2. Drinking water should be supplied in troughs. Shallow stagnant pools are a dangerous source of infestation, particularly when the pastures are dry, for at such times the animals concentrate on the green feed around them, thus heavily contaminating the ground.

3. Stock as lightly as possible. Overstocking is one of the most common factors predisposing to outbreaks. It stands to reason that the more animals there are in a pasture, the more contaminated does the pasture become and the greater the chances of the animals being infested.

4. Avoid permanent pastures for young stock. Calves and yearlings should if possible be run on pastures to which cattle have not had access for at least three months. Such pastures whilst being spelled from cattle could be grazed by horses, for the forms that occur in horses do not infest cattle and vice versa. If spelling is not possible, pastures for young stock may be cleansed of much of their infestation by firing. Firing of pastures, however, should not be given preference to spelling.

5. The state of nutrition of an animal greatly influences the degree to which it can withstand the effects of an infestation. A poorly-nourished beast is much more susceptible than one in good condition. Young animals, on being weaned should, then, be reared on an adequate and well balanced ration. During dry periods all young stock should receive supplementary foods. These can be supplied either by improved pastures, cultivation, or by hand feeding. The provision of a good lick will do much to keep the animals healthy. A useful lick may be made up as follows:—

Sterilized bone meal	70 parts
Coarse salt	25 parts
Limonite	5 parts

6. Dairy farmers should maintain the calf pens and yards in a sanitary and hygienic condition.

THE WORM PARASITES.

A large number of different kinds of worms are capable of infesting cattle and causing disease. These are either flukes, tapeworms, or roundworms.

FLUKES.

These are usually moderate sized worms either flat and leaf-like or conical in shape. They are usually hermaphrodite, that is, each fluke contains a complete set of male and female organs.

The egg when laid by the fluke passes out of the animal in the manure. Should conditions be favourable, the egg develops and eventually hatches to give rise to a tiny larval fluke. The larval fluke before it can develop any further must then find a certain species of snail into which it burrows. After spending a period of growth in the snail, the young fluke makes its way into the open again and attaches itself to the grass. When swallowed by a suitable animal it makes its way to some favoured organ, settles down and grows to maturity (Plate 59).

Two kinds of flukes are found in cattle in Queensland, namely, the conical fluke and the liver fluke.

Plate 61.
LIVER FLUKE (natural size).

THE LIVER FLUKE (*Fasciola hepatica*). (Plate 61.)

The adult liver fluke is a flat, leaf-like worm, pinkish to pale brownish in colour, and measuring up to 1½ inches in length. It is found in the bile ducts of the liver.

Its life cycle is similar to that outlined above. The snail intermediate host in Australia is known as *Limnaea brazieri*.

FLUKE DISEASE IN CATTLE.

In Queensland, fluke disease in cattle is known to occur only in the south-eastern areas. Mature cattle appear to be little affected, for despite the presence of the flukes, they usually hold their condition fairly well. The parasites, can, however, be serious in young cattle, causing unthriftiness, loss of condition, diarrhœa, and death. In advanced cases the tissues of the mouth and eyes are pale and a swelling is present under the jaws, "bottle jaw." Aged animals are sometimes seen suffering from a chronic type of fluke disease which is denoted by wasting and scouring.

A "fluky" liver has an enlarged mottled appearance. The bile ducts are thickened and impregnated with lime and stand out as whitish tubes above the liver surface. This appearance gives the infested liver the popular name of "pipey liver."

Treatment and Control.

Carbontetrachloride is used very successfully for treating fluke disease in sheep, but unfortunately is a rather risky drug to give to cattle. It may, however, be administered with a fair degree of safety to calves and yearlings, but should never be used for milking cows. The dose for young animals is 2 cubic centimetres to 5 cubic centimetres according to weight, given in a small quantity of liquid paraffin. Liquid extract of male fern is safer but not as effective as carbontetrachloride, the dose being 10 c.c. to 30 c.c. according to weight and condition.

Another drug which is widely used in other parts of the world is hexachlorethane, the dose being 20 grams to 25 grams for every 100 lb. of weight.

As a certain species of snail is necessary for the liver fluke to complete its life cycle, it follows that by destroying the snail, infestation of cattle by the fluke can be prevented. With this object in view the following recommendations are given:—

1. Marsh land, bogs, backwaters from creeks, &c., should be drained and kept as dry as possible. The banks of creeks, &c., should be kept free of all weeds and other debris to facilitate the flow of water.

2. Bluestone in very minute amounts is very poisonous to snails. It may be applied to bog lands, creeks, and other places where the snails live, in the following ways:—

   (*a*) In the case of pools and other still waters, tie a bag of bluestone to the end of a pole and drag it backwards and forwards through the water until the water has a faint blue tinge. In the case of running streams suspend bags of bluestone at intervals along the length of the stream.

   (*b*) For boggy, marshy areas, broadcast a mixture of finely-ground bluestone and sand (1 to 4) at the rate of 20 lb. bluestone per acre.

To be most effective bluestone should be used especially during the early part of the months of June and December.

THE CONICAL FLUKE (*Paramphistomum* spp.) (Plate 62.)

These are pinkish, pear shaped worms which in the adult stage are found attached to the walls of the paunch and honeycomb. They are extremely common in cattle in the coastal and subcoastal area of the State and are frequently seen in very large numbers.

Life History.

The life history of the conical fluke includes certain species of snails in which the young flukes undergo certain growth and development. This portion of the life cycle being completed, the young flukes then attach themselves to grass and are swallowed by cattle as they graze. Inside the animal the young flukes (Plate 62*b*) then make their way to the small intestine and attach themselves to its wall. Finally the parasites make their way back to the paunch and honeycomb where they grow to the adult stage (Plate 62*a*).

Effect on Cattle.

The adult flukes in the paunch and honeycomb, even when present in large numbers, are not considered to be very harmful. During the time the parasites are present in the small intestine, however, they are capable of causing serious damage. The intestine wall becomes very inflamed and the animal is afflicted with a severe diarrhœa which is dark in colour and evil smelling. Affected animals, particularly young stock, rapidly lose condition and grow weak. The tissues of the mouth and eyes become pale and a swelling develops under the jaws.

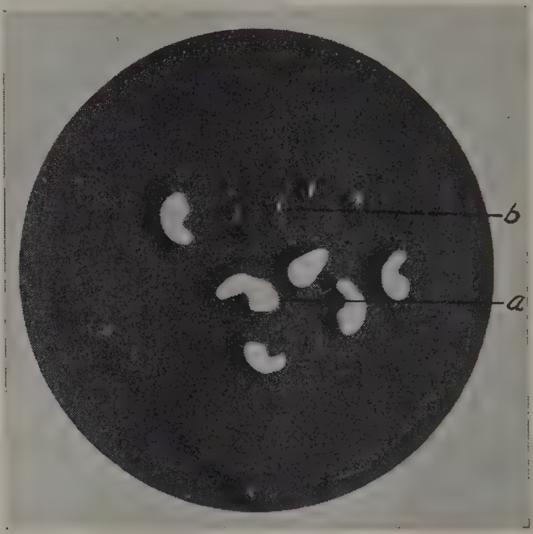

Plate 62.

CONICAL FLUKE.—(*a*) Adults from paunch and honeycomb; (*b*) young flukes from the small intestine (natural size).

Treatment and Control.

Infested animals should be first of all removed from the marshy pastures in which they are picking up the young flukes.

Nothing is known regarding an effective treatment for infested cattle, but tetrachlorethylene as recommended for the removal of the large stomach worm (see page 146) should be tried.

The snail vectors may be destroyed by the measures advised for the control of the liver fluke.

Tapeworms.

Tapewords are elongate, flat, creamy worms, which in cattle attain a length of up to 15 feet. The tapeworm has a very tiny head, which is provided with suckers with which the worm attaches itself to the wall of the small intestine in which it lives. Following the head is a slender neck, which connects the head to the body of the tapeworm. This is composed of a number of flat, short segments which become progressively broader towards the posterior end of the worm.

Life History (Plate 59).

As the tapeworm grows, the posterior segments become filled with eggs. When these eggs have reached a certain stage in their development, the "ripe" segments containing them drop off from the body of the worm and pass out in the manure. The egg must then be eaten by some particular kind of animal, such as an insect, a mite, &c., before it can develop any further. Inside the "intermediate host" the egg hatches and gives rise to a larval tapeworm. Should this larval tapeworm, or the intermediate host containing it, be eaten by the animal which passed the eggs, the larval tapeworm settles down in the small intestine and eventually reaches the adult stage.

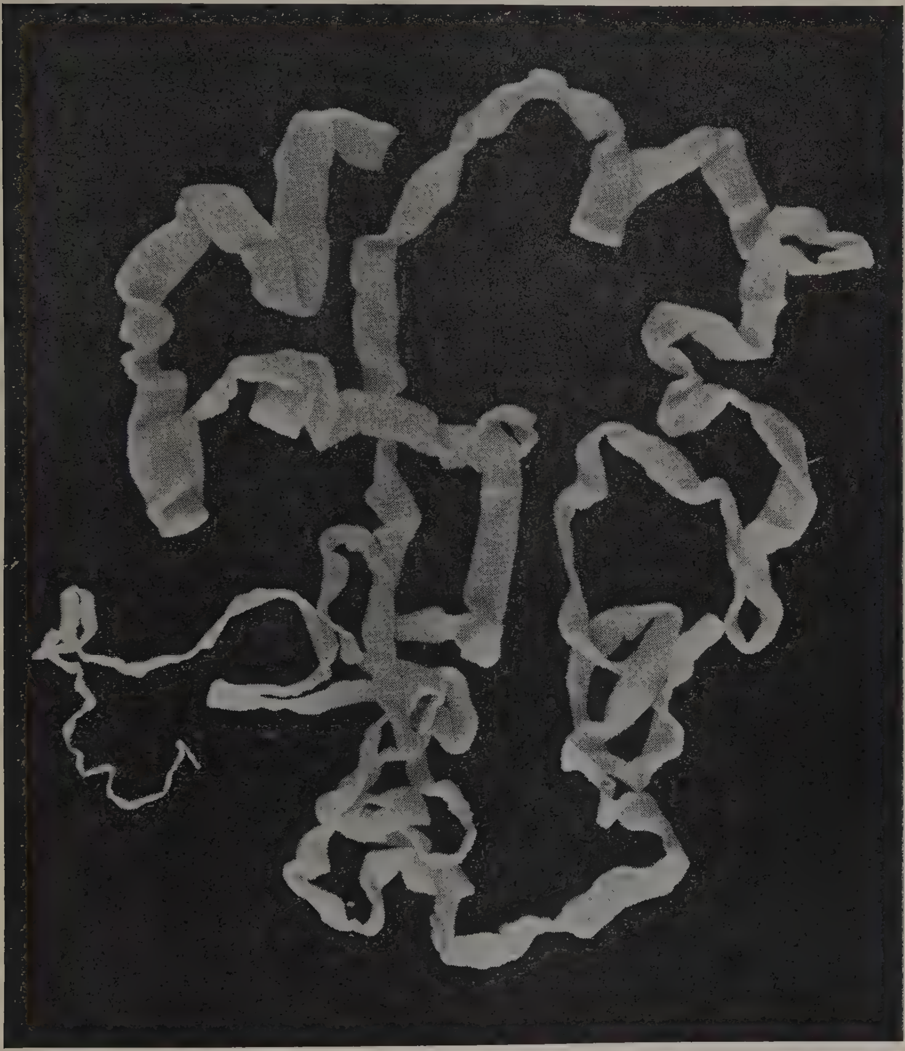

Plate 63.
TAPEWORM (natural size).

Cattle harbour both adult and larval tapeworms.

LARVAL TAPEWORMS.

Two kinds of larval tapeworms are found in cattle in Queensland, namely, water ball or *Cysticercus tenuicollis,* and hydatids or *Echinococcus granulosus.* Both of these are found in the adult stage in the dog, and other allied animals, such as the fox and wolf.

The economic importance and control of these larval tapeworms have been discussed fully in a previous article in this journal on "Parasites of Sheep.

ADULT TAPEWORMS.

Three different kinds of adult tapeworms are known to infest cattle in this State. They are very similar in appearance, the commonest form being known as *Moniezia benedeni.* They all occur in the small intestine.

Life History.

The intermediate host of only one species is known and in this case it is a tiny mite which occurs very commonly in the pastures, particularly in damp areas. The mites become infested with larval tapeworms when they swallow tapeworm eggs passed in the manure. Should an infected mite be swallowed by cattle, the tapeworm larva settles down in the small intestine where it grows to the adult stage.

Effect on Cattle.

Very little is known of the effects of tapeworms on cattle. As a rule, these parasites occur only in young animals, and it is considered that many well-grown worms must be present before any symptoms of ill-health are noticeable. In such instances, the calf will have a stunted pot-bellied appearance with a dry harsh coat. Diarrhœa may also be present.

Tapeworm infestation is denoted by the passage of segments in the dung. Before coming to any decision, however, the cattle owner should make sure that the poor condition of the animal is not really due to other worms, such a stomach worms, small intestinal worms, or nodule worms.

Treatment and Control.

Tapeworms may be successfully removed by using an arsenical drench. The formula for this drench is given below.

Formula—White arsenic (95 to 99 per cent. arsenious acid)	2 oz.
Epsom salts	6 lb.
Water	2½ gal.

Calves should be given 1½ fluid oz. to 3 fluid oz. of this mixture according to their age. No starvation is necessary, but water should not be permitted till about four hours after drenching.

Boil the arsenic slowly in 2 gallons of water for half an hour. Allow the sediment to settle then pour off and retain the clear fluid. Add the epsom salts, stirring well till it is dissolved and make up to 2½ gallons.

The mites which carry the larval tapeworms are most numerous in wet pastures, particularly in shaded areas. These should be avoided as pastures for young stock. Attention is also drawn to the general preventative measures discussed on page 139.

ROUNDWORMS.

These, as their name implies, are elongate, rounded, worms, and include some of the most serious worms infesting livestock. They vary tremendously in size. In our cattle, for example, the largest species measures up to 4 inches in length and the smallest less than $\frac{1}{4}$ inch.

The sexes are usually separate, that is, there are male and female worms, the male being the smaller. Some kinds of roundworms require an intermediate host in which to complete their life cycle, in which they resemble tapeworms and flukes, but the majority reproduce in the following manner:—

The female worm lays eggs which are passed out in the manure. Under suitable conditions of temperature and moisture the egg eventually hatches and gives rise to a tiny larval worm: The larva continues to grow and develop in the pastures and eventually reaches a stage when if swallowed by a suitable animal it is capable of growing to the adult stage. The "infective larva," as it is called, crawls up the grasses when these are wet with dew or rain, and is thus available to a grazing animal(Plate 59).

THE LARGE STOMACH WORM OR BARBER'S POLE WORM

(*Haemonchus contortus*) (Plate 64).

This species is found in the fourth stomach. The female worm measures up to one and one-quarter inches in length and is red and white spirally striped. Hence the name barber's pole worm. The male is smaller than the female and pinkish in colour.

Plate 64.

Large Stomach Worm or Barber's Pole Worm (natural size).

Life History.

During the warm moist conditions of summer, the eggs passed in the manure hatch in about 24 hours. The larvæ reach the infective stage in about four to five days. The larvæ then crawl up the wet grass blades and are swallowed by the animals as they graze. Making their way to the fourth stomach, the young worms settle down and become mature in about three weeks.

Effect on Cattle.

The large stomach worm is the most serious parasite the cattle owner has to contend with, young animals under about eighteen months of age being chiefly affected.

This worm is a blood sucker and the effects of an infestation are principally those associated with a loss of blood. The blood becomes thin and watery and the mucous membranes of the eyes and mouth lose their healthy pink colour and become pale and even white. The coat is dry and rough and a dropsical swelling develops under the jaws. Sometimes diarrhoea is present. Heavily infested animals rapidly lose condition and become weak. They show a disinclination to move about and stand in a dejected manner (Plate 60).

Treatment and Control.

Probably the most effective drug to employ against this parasite is tetrachlorethylene. It is given mixed with an equal quantity of liquid paraffin immediately after administration of half a cupful of a 5 per cent. solution of baking soda (½ lb. of baking soda dissolved in 1 gallon of water). By giving the baking soda first, the tetrachlorethylene goes directly into the fourth stomach in which these worms live. If the baking soda is omitted the tetrachlorethylene may fall into the paunch, where it becomes so diluted that by the time it reaches the fourth stomach, it has little effect on the worms.

The doses of tetrachlorethylene and liquid paraffin are as follows:—

Animals 2 to 4 months ..	10 c.c. to 15 c.c. of each
Animals 4 to 8 months ..	15 c.c. to 20 c.c. of each
Animals 8 to 12 months ..	20 c.c. to 25 c.c. of each
Animals 12 to 18 months ..	25 c.c. to 30 c.c. of each

Some authorities recommend a bluestone solution which is made up as follows:—

Bluestone	1 lb.
Water	2½ gal.

Doses—

Animals 2 to 4 months old ..	1½ to 2 fluid oz.
Animals 4 to 8 months old ..	2 to 3 fluid oz.
Animals 8 to 12 months old ..	3 to 4 fluid oz.
Animals 12 to 18 months old ..	4 to 5 fluid oz.

The bluestone used should be fresh and blue in colour, and any white powder should be discarded. When making up this drench use only enamel or earthenware vessels, as bluestone corrodes unprotected metal surfaces.

No starvation is required for either the tetrachlorethylene or bluestone drench.

In the case of outbreaks the animals should be drenched at least twice at an interval of 10 to 14 days.

Cattle become infested during the warmer months of the year, but may not show any obvious symptoms till the winter and early spring. In areas where stomach worms are troublesome, therefore, it is of the greatest importance to send the susceptible young stock into the winter as free from worms as possible. They should be drenched in January and again in April. A further drench is advisable in June or July.

Where these parasites are particularly prevalent, drenching at intervals of two months or less from November to June or July may be necessary to keep the young cattle healthy.

The general preventive measures discussed on page 139 should be enforced as far as practicable, particularly those measures dealing with permanent calf pastures, calf rearing, and nutrition.

THE LESSER STOMACH WORM (*Ostertagia ostertagi*). (Plate 65.)

This is a slender brownish worm, about half an inch long, which is found lying against the wall of the fourth stomach.

The life history is very similar to that of the large stomach worm, differing from it only in detail.

Plate 65.

LESSER STOMACH WORM (natural size).

These worms are best seen by scraping the wall of the fourth stomach and examining the scrapings in a glass dish held over a dark background. The worms are most numerous in that part of the stomach which leads into the small intestine.

Effect on Cattle.

In some parts of the world, the lesser stomach worm is a serious parasite in cattle and may cause marked loss of condition, anaemia, and diarrhoea. It is very common among cattle in Southern Queensland, particularly in the south-eastern districts, where it may at times become sufficiently numerous to be a contributing factor in outbreaks caused by other worms, such as the large stomach worm or large bowel worm.

Treatment and Control.

The tetrachlorethylene treatment as recommended for removal of the large stomach worm would be the most promising treatment to use against this worm.

If the preventive measures discussed on page 139 are put into operation, the lesser stomach worm will be of little importance.

THE STOMACH HAIR WORM (*Trichostrongylus axei*). (Plate 66.)

This is an extremely slender, reddish, hair-like worm which rarely attains a length of more than half an inch. It is found in the fourth stomach in the same situation as the lesser stomach worm. Its life history differs only in detail from that of the larger stomach worm. Whilst an important parasite of cattle in temperate countries like England, it rarely becomes sufficiently numerous to be serious in Queensland cattle. It is to be seen chiefly in the south-eastern areas of the State.

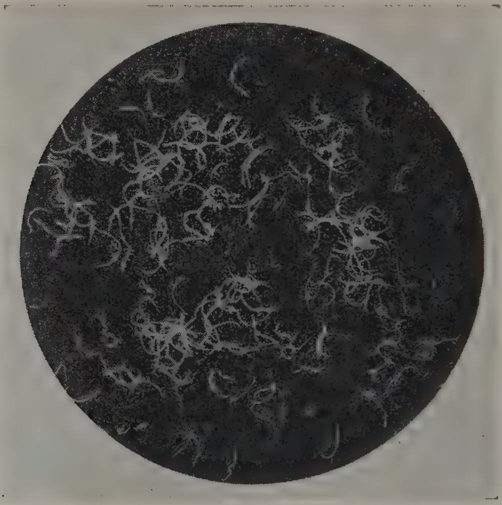

Plate 66.
STOMACH HAIR WORM (natural size).

The worms are best seen by the method advised for detecting the lesser stomach worm.

Treatment and Control.

The measures advised for treatment and control of the large stomach worm should be effective against the stomach hair worm also.

THE HOOKWORM (*Bunostomum phelbotomum*). (Plate 67.)

This is a stout whitish worm up to about an inch in length which occurs in the first part of the small intestine. The mouth of this worm is provided with a number of teeth, by which it adheres firmly to the intestine wall.

Life History.

The early part of the life history of the hookworm up to the development of the infective larva in the pastures is similar to that of the large stomach worm. Although infection by the hookworms can occur when the infective larva is swallowed, it most usually takes place by the larva boring through the animals' skin. This can happen whenever a part of the body comes into contact with soil containing hookworm larvæ. Having penetrated the skin the larvæ reach the blood vessels which carry them to the lungs. From the lungs they then travel via the windpipe into the mouth and are swallowed, thus reaching the small intestine where they settle down and grow to maturity.

Effect on Cattle.

The hookworm is very common among cattle in this State, particularly in the coastal areas.

Like the large stomach worm, it is a blood sucker and consequently affects cattle in much the same way. The membranes of the eyes and mouth become bleached, the animal suffers from diarrhœa, and loses condition rapidly. A swelling develops unde the jaws and the coat is rough and dry. The animal figured in Plate 60 might be suffering from either stomach worms or hookworms, so similar are the symptoms. As with the large stomach worm, too, hookworms are rarely of any importance among animals over about two years of age.

Plate 67.
HOOKWORM (natural size).

Treatment and Control.

The tetrachlorethylene treatment recommended for the large stomach worm would probably be effective against hookworm also.

Evidence seems to show that moist sandy pastures and overstocking are particularly dangerous in so far as hookworm is concerned. In considering the general preventive measures discussed on page 139 particular attention should therefore be given to these two factors.

SMALL INTESTINAL WORMS (*Cooperia* spp.).

(Plate 68.)

These are small pinkish worms up to one-third of an inch in length, which infest the first part of the small intestine. They are somewhat stouter than the stomach hair worms, and if scrapings are taken from the intestine wall and examined in a glass dish held over a black surface, the small intestinal worms may be readily detected by their coiled up appearance.

Their life-history is similar to that of the large stomach worm, cattle becoming infested when they swallow the infective larvæ.

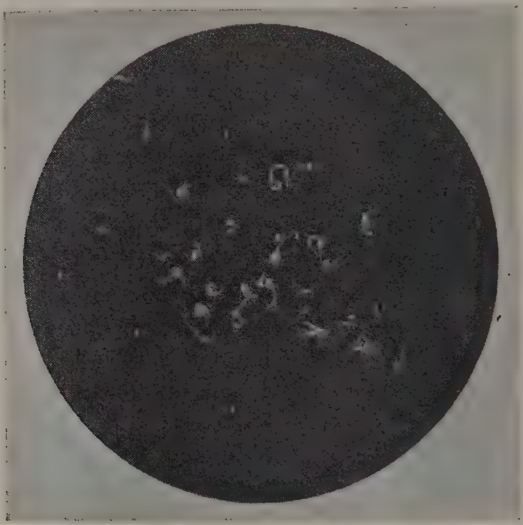

Plate 68.
SMALL INTESTINAL WORM (natural size).

Effect on Cattle.

These small worms are very common among cattle, especially in the coastal belt, and, when in sufficient numbers, can cause diarrhœa and loss of condition. Young cattle are chiefly affected. Anæmia is not a very pronounced symptom and in cattle infested with these parasites one does not see any marked bleaching of the membranes of the eyes and mouth, nor any development of a swelling under the jaw.

Treatment and Control.

Tetrachlorethylene as recommended for the removal of the large round-worm should be tried and the general preventive measures given on page 139 should be practised.

THE LARGE BOWEL WORM (*Bosicola radiatum*).

(Plate 69.)

This is a stout, whitish worm up to three-qarters of an inch in length, which occurs in the large bowel. The worms lie close against the bowel wall, sometimes burying their anterior ends into it and causing a conspicuous pitting.

Life History.

Larva hatch from eggs passed in the manure and develop to the infective stage in the usual way. These infective larvæ on being swallowed by cattle make their way into the intestine, and burrow into the intestine wall, particularly that of the large intestine or large bowel. Later on the worms return to the large bowel, where they settle down and grow to maturity.

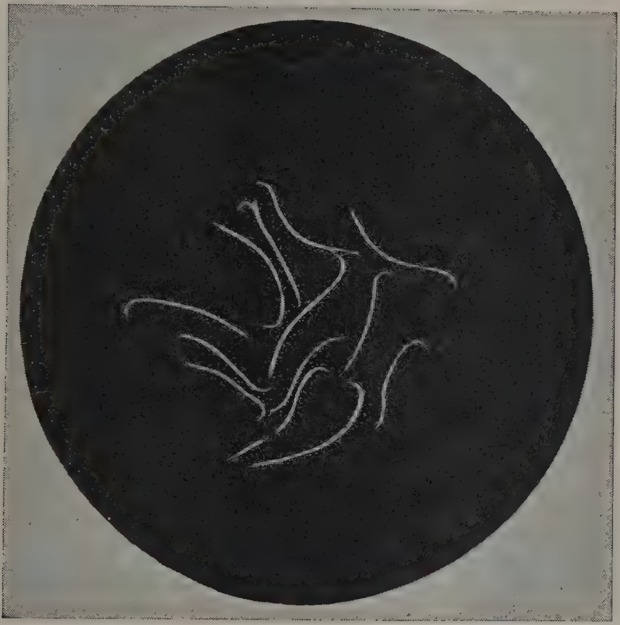

Plate 69.
LARGE BOWEL WORM (natural size).

Effect on Cattle.

This worm is an extremely common parasite in Queensland, particularly in the coastal areas, and when in numbers in young stock can be responsible for anæmia, loss of condition, and diarrhœa. Diarrhœa is a very characteristic symptom, the dung being watery in consistency and containing quantities of mucus.

The larvæ, when they burrow into the gut wall, cause the formation of nodules. Nodules are more conspicuous in older cattle, and, when in numbers, interfere with the movements of the gut and so contribute to the general ill-effects of an infestation.

Among young stock, infestation with this parasite can be fatal. Should recovery occur the animal in many instances may remain stunted in growth and unthrifty.

Treatment and Control.

As no treatment is known which will remove this parasite, control rests entirely upon the application of preventive measures.

THE WHIPWORM (*Trichuris* spp.).

(Plate 70.)

These worms are found in the caecum or blind gut. They derive their popular name from their resemblance to a whip, the anterior portion being long and slender like a lash, and the posterior portion short and stout like a whip handle.

Plate 70.

WHIPWORM (natural size).

Life History.

The whipworm egg is passed on to the pastures in the manure. Under favourable conditions a tiny larva eventually develops inside the egg. Unlike other worms infesting cattle, however, the larva does not hatch out until the egg is swallowed. Then, on being set free inside the animal, the larva makes its way to the blind gut, where it settles down to grow to maturity.

Effect on Cattle.

Although a common parasite of cattle, whipworms are not considered very harmful, unless present in very large numbers, which is a comparatively rare occurrence.

Treatment and Control.

No effective treatment is known and control rests entirely on preventive measures.

THE LUNGWORM (*Dictyocaulus viviparus*).

(Plate 71.)

The lungworm is an elongate, slender, whitish worm which grows up to 3 inches and more in length and is found in the air tubes of the lungs.

Life History.

The eggs laid by the female worms in the lungs are coughed up and swallowed. On their way through the alimentary canal they hatch.

The tiny larva that emerges from the egg is then passed out in the manure. Some eggs may be coughed out of the mouth in the sputum and saliva.

After the usual period of development in the pastures the larvæ eventually reach the infective stage. They then infect an animal per medium of its food or water. Once inside the animal they bore through the intestine wall and reach the lymph glands from which they are eventually carried to the lungs. Here they then make their way into the air tubes, settle down, and grow to the adult stage.

Plate 71.
Lungworm (natural size).

Effect on Cattle.

Lungworms are serious chiefly among calves and young cattle. A few lungworms do little harm, but when present in numbers they induce frequent coughing and there are signs that the animal is finding it difficult to breathe. The animal becomes weak and listless and frequently suffers from diarrhœa. Eventually the breathing rate becomes very rapid and the animal may die. Bunches of worms are frequently coughed up in a quantity of blood-stained frothy material.

These effects are due to the masses of worms in the air tubes, which so irritate the lung tissue as to cause pneumonia.

Treatment and Control.

Lungworm disease in cattle is usually associated with two factors—namely, poor nutrition and a heavy infestation of other worms. The following treatment is therefore indicated:—

(1) Remove affected animals from the pasture in which they have been running and provide them with warm quarters and nutritious food.

(2) Drench with tetrachlorethylene as advised for the large stomach worm. This drench removes most of the stomach and intestinal worms and enables the animal's resistance against the lung worms to be increased.

In most cases if these two measures are put into operation, lungworm outbreaks can be controlled.

The only other treatment available is an injection of drugs into the windpipe by means of a sterilised hypodermic syringe. The operation is not an easy one and should be carried out under the supervision of an experienced neighbour or a stock inspector. The formula employed is as follows:—

Turpentine	1 drachm
Glycerine	1 drachm
Chloroform	1½ drachm
Carbolic acid	10 minims

The general preventive measures already outlined, if put into practice will do much to control lungworms. Special attention should be given to the avoidance of damp pastures for calves, as these favour the development and survival of lungworm larvæ.

THE BEEF NODULE WORM (*Onchocerca gibsoni*).

This is an extremely common parasite of cattle in Queensland. The worms occur in the form of nodules, chiefly in the brisket and stifle regions. The nodules vary from the size of a pea up to a diameter of about 5 inches. If a nodule is cut open the worms may be seen inside it, intricately tangled up in the tissues (Plate 72). Each nodule contains a female and one or more male worms. The worms themselves are slender and very fragile. The female worm may measure up to 20 inches and more in length and the male up to 4 inches.

Life History.

Despite the attention by a number of workers in Australia, the life history of the beef nodule worm has not yet been worked out in this country. Recently, however, studies made in Malaya show that the parasite is spread by certain species of sandflies. When these sandflies bite cattle, they ingest the worm larvæ which occur in the skin. These larvæ undergo a necessary part of their development in the sandfly, and when the infested fly bites another animal the larvæ are liberated and eventually penetrate the skin. After moving around in the animal for some time, they settle down in the brisket and stifle. As a result of their presence here, the tissues around them gradually form a nodule.

Effect on Cattle.

The beef nodule worm does not appear to be harmful in any way to cattle themselves, but as nodule-infested briskets are not permitted entry into the United Kingdom, the loss to the beef industry, through the removal of this portion of the carcase from all animals before it can be exported, is very heavy.

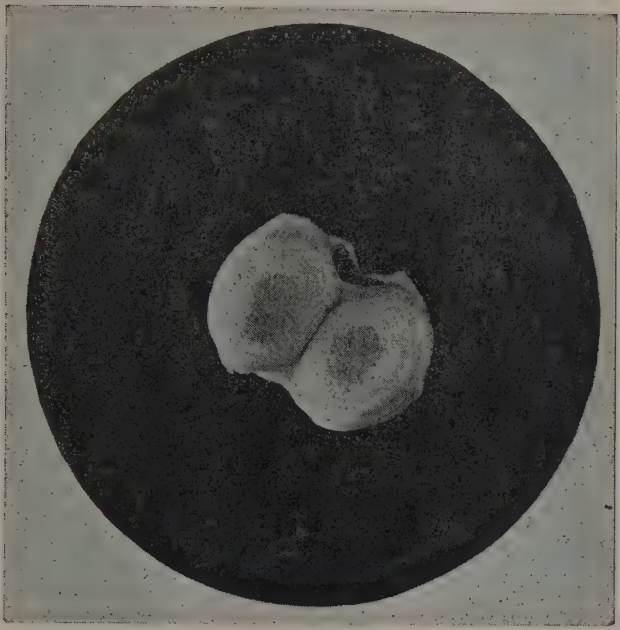

Plate 72.

BEEF NODULE.—The nodule has been cut open to show the intricately coiled worm within.

Control.

Obviously any control measures against this worm must take into consideration control of the sandflies which spread it. These tiny flies breed in a wide variety of situations, such as mud, rotting vegetation, manure heaps, &c., and under the conditions present in the areas where the cattle become infected, control of these flies does not appear at the present time to be very feasible.

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Fused Needle Disease and its Relation to the Nutrition of Pinus.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

(*Continued from p.* 54, *January,* 1940.)

The Economic Importance of the Disease.

The economic importance of fused needle disease depends on the combination of the effect on individual trees and the intensity of distribution of these trees throughout the plantation. If the incidence is light, as is the case in most Queensland plantations, affected trees are eliminated in the normal course of time during thinning operations and no loss is sustained. The presence of fused needle, even in small amounts, may be indicative of a general subnormal condition throughout the area thus affected, and the extent of the loss thus caused is difficult to estimate.

(i.) Effect on the Individual Tree.

Severely affected plants lose the habit of a tree and become shrub-like by developing multiple leaders, and in this way become useless for timber purposes. Observations have, however, shown that there is a tendency to throw off the malady after a number of years, depending on the time taken for the formation of a surface litter on the soil or perhaps on successful root grafting with healthy trees. However, the delayed growth experienced (Table II.), even if recovery ultimately occurs, causes a considerably augmented plantation cost, due to the additional tending and protection work which it is necessary to carry out during the longer period ensuing until the trees become mature. There is also the likelihood of the recovered trees being of reduced market value owing to the malformation developed during the diseased period. In California, according to information provided in correspondence with the Director of the Institute of Forest Genetics, considerable loss of time has been caused by fused needle disease when it has attacked trees being used for genetical purposes at Placerville.

(ii.) The Incidence of the Disease in Queensland.

In certain small localized areas in Queensland the incidence of the disease is very marked, but this can by no means be taken as a criterion of the general plantation effect. The high figures recorded (Young, 1935) in one very interesting block of 40 acres at Beerwah have, however, apparently been taken by unwitting readers to refer to Queensland plantations of *Pinus* in general. This is not the case, and the Beerwah plantations as a whole have a relatively low percentage of the trouble, which has been estimated at 6·2 per cent. of the plantation total. The extremely high incidence of affected trees in certain areas was made use of for experimental work, as these places provided the most satisfactory conditions for phases of the investigations requiring enough trees to admit of statistical analysis.

In the field the individual cases of the typical disease occur in a haphazard manner over any affected area and when plotted on a chart show no organized grouping, being randomized amongst the healthy plants. The actual proportion of healthy to diseased trees varies greatly with the location and may range from total absence to over 80 per cent.

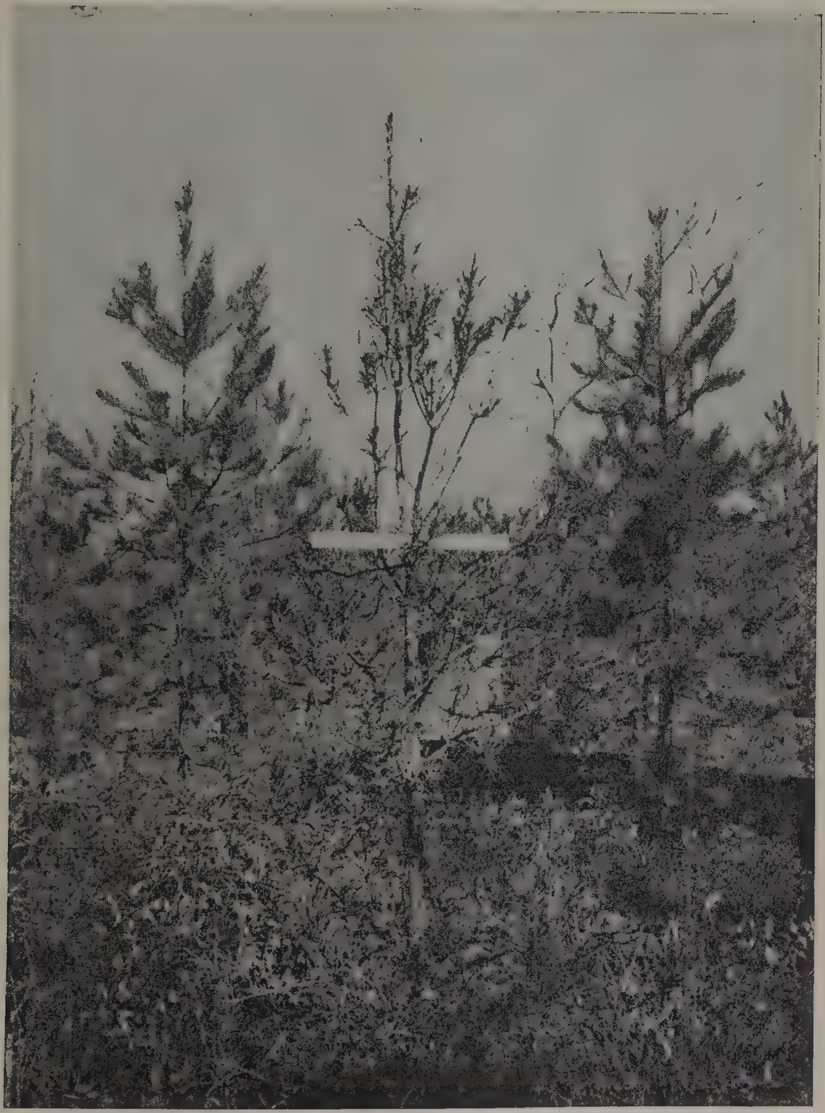

Plate 73.

Fused needle disease in eight-years'-old plantation tree of *Pinus tœda*. (Fifteen-inch rule inserted in tree.)

(iii.) Progressive Distribution in Individual Plantations.

The disease has been noted in nursery seedlings nine months old, and has appeared as a new attack in trees of all ages up to eleven years. Beyond this age effective observations have not been possible owing to the absence of plantation trees in any number older than this. The most critical period in the life of *P. tæda* and *P. caribæa* as regards attack is from the fourth to the sixth year.

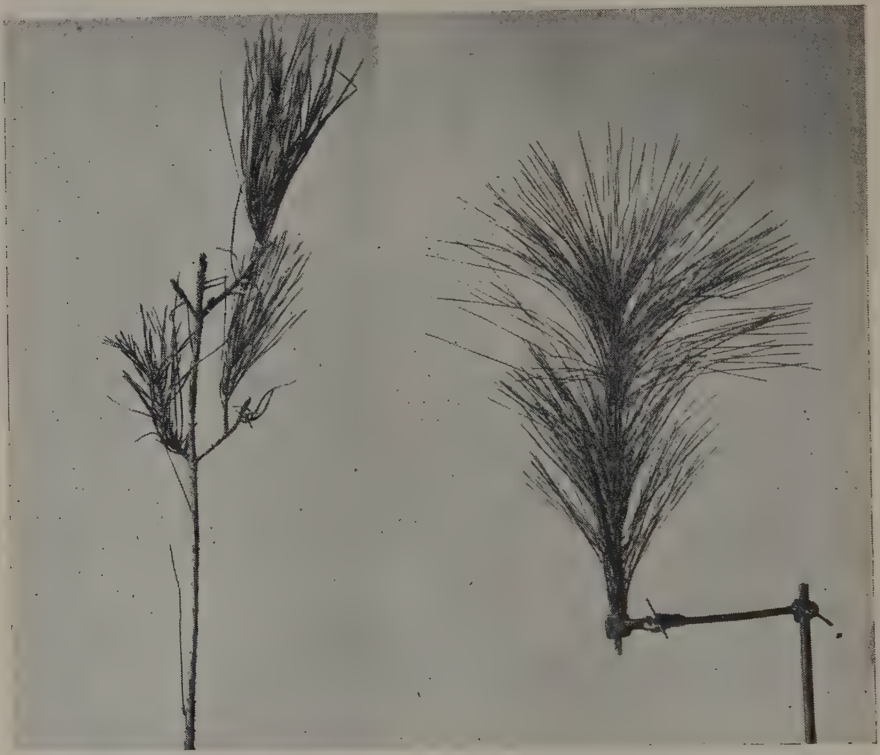

Plate 74.

Needle fusion symptoms in *Pinus tæda*. (Left) Branch affected with needle fusion, showing suppressed terminal growth. (Right) Healthy branch for comparison.

In order to obtain data on the history of trees affected with the disease three observation plots (A, B, and C) were commenced in a very severely-affected area at Beerwah in 1933 and have been continued up to the present, with the exception of plot A, which was abandoned in 1935 as being unlikely to furnish useful information. Two further plots (D and O) were established in 1934 and 1937, respectively, in a different area which is more nearly normal than that first used. The results of the plots to date from the five plots A, B, C, D, and O are contained in Table I. The general incidence of the disease in the areas in which the experiments are established is less than that shown for the sites concerned.

TABLE I.

Progress of the Occurrence of Fused Needle in Five Observation Plots as Illustrated by Percentage Infection at Yearly Intervals.

Year.	Plot A. *P. taeda* (1929 planting.)	Plot B. *P. caribaea* (1929 planting.)	Plot C. *P. tæda* (1929 planting.)	Plot D. *P. caribaea* (1932 planting.)	Plot O. *P. caribaea* (1932 planting.)
1933	53·6	..	..	..	..
1934	74·4	63·5	87·6	5·6	..
1935	79·5	69·0	88·8	29·2	..
1936	..	62·7	82·7	25·8	..
1937	..	56·3	92·6	33·7	22·6
1938	..	76·2	100·0	37·0	32·3
1939	..	61·9	97·0	40·7	40·7
No of trees per plot ..	60	126	109	86	247

Observations were made on all plots at midwinter (June) when the trees were dormant as regards needle production and height growth, and again at the dormant period in midsummer (January), which occurs between the two periods of shoot elongation in Southern Queensland. The midsummer observations entailed descriptive observations of the trees, whilst at midwinter the actual height of the trees from the ground to the terminal bud was measured in addition. The midsummer results for fused needle incidence usually showed a lower percentage than that obtained for the previous and following midwinter. The second winter showed a tendency to a greater incidence of fusion than was the case twelve months before. The reason for this summer fluctuation will be discussed later.

TABLE II.

The Mean Annual Height Increment in Feet of Trees in Observation Plots.

Species.	Plot.	Period.	All Trees.	Healthy.	Diseased.	Difference.	No. Trees per plot.
P. caribœa	B	1934-37	2·53	3·01	2·24	0·77	126
		1937-38	2·83	3·69	2·26	1·43	..
		1938-39	2·80	3·31	2·40	0·91	..
P. tœda	C	1934-37	1·40	2·10	1·35	0·75	109
		1937-38	1·47	1·47	1·47	Nil	..
		1938-39	1·33	1·30	1·31	Nil	..
P. caribœa	D	1934-37	1·96	2·20	1·30	0·90	86
		1937-38	3·64	3·95	3·37	0·58	..
		1938-39	3·58	3·77	3·41	0·36	..
P. caribœa	O	1937-38	2·55	3·25	0·99	2·26	247
		1938-39	3·15	3·14	3·20	Nil	..

TABLE III.

Girth Measurements in Observation Plots.

Species.	Plot.	Mean Girth in Inches at June, 1939.			Difference.
		All Trees.	Healthy.	Diseased.	
P. caribœa	B	9·38	12·07	8·80	3·27
P. tœda	C	7·95	7·95	7·95	Nil
P. caribœa	D	10·86	11·52	9·64	1·88
P. caribœa	O	9·42	9·35	9·38	Nil

The observations obtained from the plots indicate a tendency towards a general increase in the incidence of the trouble on affected sites until it reaches a maximum as shown in plot C with *Pinus tæda.* In the year 1936 there was, however, a lowering of the incidence of the disease in all plots, and this drop interrupted the tendency to increase. This fall was probably due to the better season resulting from an abnormally high rainfall during that period. In the next season (1937) however, there was a return to the general trend towards a worsening of the condition.

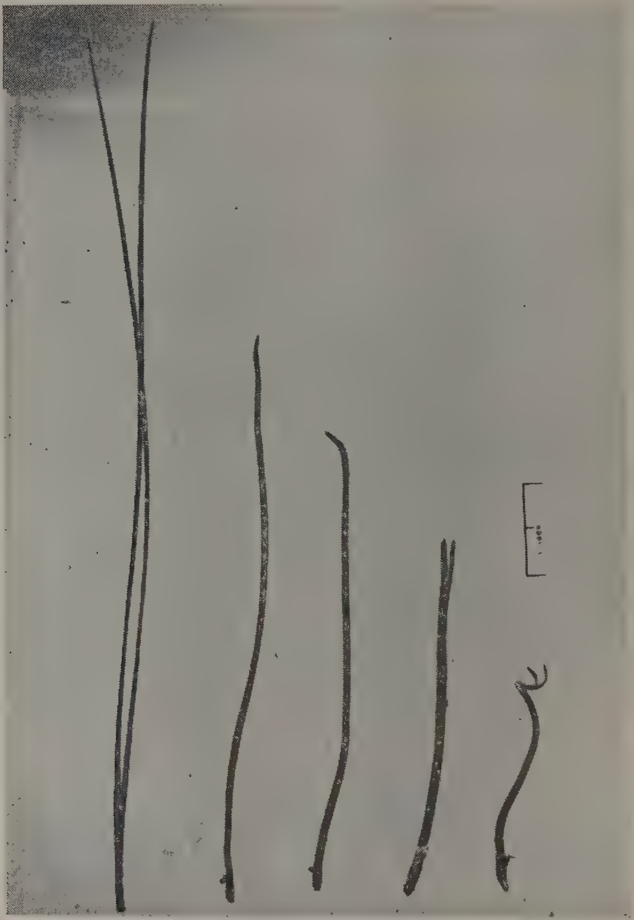

Plate 75.

Fascicles of *Pinus caribæa,* showing various stages of needle fusion. Healthy fascicle on left.

Annual and total height increments taken from observation plots are shown in Table II., and it will be noted that the increment put on by the diseased trees in the majority of the plots is much less than that produced by healthy trees.

In the case of Blocks C and O the height growth for the season 1937-38 and 1938-39 was the same for diseased and healthy trees, indicating that the plot as a whole was really affected although typical symptoms were not present throughout the experiment. The average increment was very small in this plot. It will be seen that the growth difference in trees with definite symptoms and normally healthy trees was appreciable and that it is of definite economic importance.

In several instances it was noted that the height increment was negative in the case of individual trees. These trees were in all cases severely affected ones which were subject to death of the leading shoots. The secondary shoots put forth below the dead ones did not reach the height of their predecessors, and thus an actual decrease in height resulted for the season's growth.

Plate 76.
Typical aspect of area subject to needle fusion (*Pinus tæda*).

General observations have shown that, with the closure of the crowns to form a complete canopy, there is less liability to attack by the disease and that, provided competition within the stand due to the need for thinning is not allowed to become so acute as to cause dieback and death, the trees will continue in good health. The age of crown closure in a new plantation would thus appear to become an important feature of the healthy growth of the species of *Pinus* (*P. tæda* and *P. caribæa*) observed. At Beerwah in South Queensland the age of a healthy stand of *P. tæda* when crown closure occurs is from six to eight years when planted with an 8-feet by 8-feet spacing. It must be understood, however, that, owing to the disabilities concurrent with the incidence of fused needle disease, it is possible that a severely affected stand will never reach this stage within the limits of plantation life, unless corrective treatments are applied. The effect of the crown closure is intimately connected with the resulting accumulation of a surface litter on the soil as will be discussed later.

III. PRELIMINARY INVESTIGATIONS INTO THE CAUSE OF THE FUSED NEEDLE CONDITION.

The possible causes of the disease were discussed in a previous paper (Young, 1935) and also by Ludbrook (1937). It is agreed by both writers that the possibility of the disease being due to entomological factors is remote and that no parasitic fungus or bacterium is constantly associated as a primary factor in the cause of the disease.

Experimental work in Queensland has been carried out on the primary hypothesis that the disease is due to physiological causes of non-parasitic origin and that the mycotrophic nature of the conifers concerned is in particular bound up with the development of the condition. The possibility of there being other explanations has not, however, been overlooked. The viewpoint that the malady might be due to a virus has also been intensively examined as well as the possible occurrence of factors associated with climate, genetic constitution, and soil constituents. A résumé of the work carried out on these aspects of the problem will now be given.

The Virus Hypothesis in Relation to Fused Needle Disease.

When the problem was first reviewed the possibility of the disease being of a virus nature was given considerable attention and much detailed work was carried out to investigate this aspect of the problem. The chief avenues explored are summarized below.

(i.) Mechanical Inoculations.

Numerous inoculations into healthy plants with material obtained from diseased tissues were made. The methods of inoculation used were by means of a hypodermic syringe with which diseased extractives were introduced into buds, shoots, and stems, and by rubbing scratched foliage with diseased tissues and extractives. The extractives were made by expressing the juice from freshly-gathered diseased specimens, chiefly new growths and needles. In some cases the resulting sap was centrifuged in order to precipitate the larger particles. Inoculations were carried out at all stages of growth of susceptible species, both in the field and in the glasshouse.

In no case did the diseased condition appear in healthy plants as a result of inoculation by these means.

(ii.) Serological Tests.

In order to explore all avenues which might provide evidence of the nature of the disease a series of serological experiments were designed and carried out. The tests were fully described in a previous report (Young, 1935), and the results were completely negative. In the experiments, fused needle and healthy sera were obtained by bleeding rabbits which had previously been inoculated with a series of injections with diseased and healthy pine saps. The sap was cleared before injecting by means of centrifuging. The sera obtained were used for conducting a series of precipitin tests. The precipitins to normal pine material were first thrown down in the reactive sera by means of adding normal pine extract (purified by centrifuging with barium sulphate) to the diseased sera until no further precipitate was formed. The diseased pine sap prepared in the same way was then added, and if the test were positive for a virus a further precipitate should have resulted. However, no more was obtained no matter what dilutions of sap and sera were used. As a control on the method used, a strain of tobacco mosaic, known to be due to a virus, was treated in a similar way with positive results. The fact that the serological tests for fused needle were negative ones does not, in itself, eliminate the virus possibility, because it is recognized that a number of known viruses have not as yet been demonstrated serologically, but in conjunction with other virus tests the experiments provide some evidence against the possibility of the disease being due to such a cause.

(iii.) Grafting Experiments.

Graft transmission has proved a successful mode of transmission of many virus diseases, and this method of testing for the presence of such a pathogen was attempted with fused needle. A number of successful unions between diseased and healthy tissues of *Pinus tæda* and *P. caribæa* were made both in the field and with potted plants. In grafting the potted plants the method of inarching was used, and this method was also used in several cases in the field. After the union was completed the scion was severed from its parent plant. The majority of the field grafts, however, were made by the cleft or the rind-grafting methods, and with these latter modes of union a 10 per cent. success was achieved.

In the case of all the grafts made, except one cleft graft, the healthy scions worked on to the diseased stocks became diseased in the same or the following season, and, similarly, diseased scions grafted to healthy stocks became healthy. In the exceptional case noted, the healthy scion has remained healthy for five seasons after union had taken place, although there is some evidence of the "thin crown" type of the disease now appearing (1939). *Pinus tæda* united with and grew successfully when grafted on to *P. caribæa,* and *Pinus caribæa* grew successfully with *P. tæda* as a stock (Plate 77). Both lateral and leader grafts were made. Grafts completed five seasons ago have, so far, failed to show any evidence of disease transmission.

It was suggested by G. Samuel, in correspondence, that root grafting should also be carried out as final evidence for or against the virus theory. Root grafts carried out in the field at Beerwah between very badly diseased and quite healthy plants have now been observed for over four years without any evidence of transmission of the disease being noted. Phony disease of the peach is notably a difficult virus to transmit artificially, and it may take up to two years for the healthy member of a root-grafted pair of peach trees to contract the symptoms. It might be expected, therefore, that fused needle, if a virus, would show some evidence of its action within four years. The method used in root grafting the pine trees was to select a severely-diseased tree which was surrounded by normal, healthy trees in the plantation. The surface lateral roots of the trees in the group were then bared of soil and followed out and freed from the substratum. Grafts were made between roots from healthy trees and roots from diseased trees by means of the approach graft method (Plates 78 and 79). In this way as many as twenty root grafts were made from, in some cases, four healthy surrounding trees on to one diseased tree. Ninety-eight successful unions were thus established, involving eleven diseased trees, the percentage of successful grafts exceeding ninety.

An unforeseen result was obtained from the root-grafting experiment when it was noted that, in cases where a large number of grafts had been successfully achieved between several healthy and one diseased tree, the diseased tree, at the end of the second-growing season after

Plate 77.

Tree with peg showing effect of grafting fused leader of *P. caribæa* on to healthy *P. tæda* stock. Union near ground level (cleft graft).

Plate 78.

Root grafting experiment. View showing pegs marking root grafts on to central tree (fused) of *Pinus tæda.*

Plate 79.

Root graft *in situ* on *Pinus tæda* (fused to healthy tree).

union, had become normal and lost its fused-needle symptoms. A possible explanation of this effect will be discussed under another heading.

In carrying out field grafts for fused needle disease investigations it is considered that in the case of root grafting, even-aged established trees should be used as both components of the union. If a younger and/or smaller tree, possessing the diseased or healthy symptoms required, is planted in an already established older stand, any results achieved are liable to be seriously influenced by the effects of suppression brought about by the competition for moisture, nutrients, and light with the established plants. That is, all grafting in a plantation should be carried out with plants growing *in situ.* It is suggested that the absence of response to grafting by some of the scions, as reported by Ludbrook (1937), may have been due to these factors.

(iv.) Search for Insect Vectors.

In entomological surveys carried out by the writer (1935 and later) and Ludbrook (1937), no insects were noted which were constantly associated with the disease and which were likely vectors of a virus. Some attention was given in the Southern States of Australia to *Pineus boerneri,* an insect known generally to Australian foresters as *Chermes,* and which is parasitic on many species of *Pinus,* but which in Queensland, however, only appears to seriously affect those species grown in places in which their normal requirements are in some way lacking. In Queensland this insect has not been found at Beerwah, at which place are to be seen the most severely-affected fused needle areas in the State.

(v.) Conclusion.

The opinion was finally arrived at that a virus effect could not, on the evidence available, be correlated with the occurrence of fused needle disease. This conclusion has been confirmed by Ludbrook (1937). In a preliminary note on the condition by Jones (1938), this one has not been included among the possible causes, neither has Kessell referred to a possible virus cause in connection with his fused needle experiments.

Climatic Factors in Relation to Fused Needle Disease.

It was noted by Rodger (1931) that the disease in California was most prominent in trees planted in regions of high temperature and low humidity such as at San Bernardino and at Placerville and the Director of the Institute of Forest Genetics at the latter place was of the opinion that the trouble was connected with these two climatic factors. Rodger points out in his report that the trouble appears mainly in trees whose habitat is a reasonably humid one. Observations carried out in Australia (Young, 1935) have shown, however, that the disease occurs there in all climatic conditions, from wet tropical North Queensland to the cooler uplands of southern New South Wales and in regions of summer and winter rainfall, and that the humidity-temperature factor is not the sole deciding influence. It is, however, considered possible that the low humidity and high temperature effect may be of considerable importance when considered as an accessory factor in relation to the mycorhizal hypothesis, which will be more fully developed later. Such low humidities and high temperatures could play an effective rôle in checking the formation of a surface litter of vegetable material on the ground in which the trees are growing.

On considering the Australian homoclimes of the native habitats of the principal *Pinus* species grown in this country, it is found that fused needle disease has been recorded in these climatic belts. An exception is to be noted in the case of *Pinus radiata*. The New South Wales Forestry Commission has decided, after considerable research extending over some years, that the most suitable climatic conditions for its growth, if a homoclimatic standard is used as a basis for enquiry, is the Mount Burr district of South Australia. In this area fused needle disease is reported to be of rare occurrence.

It is evident, however, that climate, whilst providing possible accessory factors in causing the trouble, is not directly responsible for the onset of the malady.

Genetic Factors in Relation to Fused Needle Disease.

Consideration has also been given to the possibility that there is some inherent factor of susceptibility to the diseased condition borne in the seed of diseased trees, and researches along these lines have been commenced by Ludbrook and the writer. In Queensland, seed from several diseased *Pinus tæda* trees has been sown in the nursery, and the resultant plants have been put out under field conditions at Glasshouse Mountains for comparative observation purposes. On germination, the seed sown at Beerwah produced seedlings of a uniform, abnormal colour. The stems and cotyledons were a pale creamy pink in contrast with the purple, red, and green colour of the normal seedlings. All the seed from diseased trees produced seedlings which exhibited this phenomenon, but in a few weeks became indistinguishable from the progeny of healthy trees, and, on planting out in the plantation in July, 1939, appeared quite normal. The difficulty with seed studies, however, is the poor chances of obtaining seed resulting from self-pollination of the parent trees, and it is thought possible that the negative results obtained by Ludbrook (1937) from seedlings may be due to this factor when combined with the difficulty of choosing a suitable environment for the production of fused needle symptoms.

The grafting experiments referred to above revealed an instance of a tree with a healthy scion on a diseased stock remaining so, and it is considered that a possible hereditary resistance to the typical form of the condition may explain this occurrence. The healthy scion is probably capable of existing more or less normally on the materials supplied by the stock which might possibly be insufficient for its own normal growth. The same factor is a possible explanation of the recovery of root-grafted diseased trees, which, after grafting, could obtain nutrient supplies from the healthy trees, although they themselves were unable to obtain or elaborate it in sufficient quantities for their own healthy growth.

Dr. Jacobs, of the Australian School of Forestry, at Canberra, has noted the occurrence of a considerable amount of natural root grafting in well developed stands of *Pinus radiata* at Canberra, and it is thought just possible that some of the recovery from fused needle observed in such stands may be due to this factor.

The contradictory results obtained from the transplanting experiment described later might also be explained from a genetic viewpoint.

While there may be, and probably is, a genetic factor influencing susceptibility, the actual cause of the disease in general is, from the evidence available, not due to this factor. For instance, the occurrence of very considerable variations in the incidence of the trouble in plants produced from similar seed, and given the same nursery and planting treatment, when planted in a variety of locations in the plantations, would alone show that the hereditary factor is a secondary one.

It is planned to follow the genetic aspects of the matter further chiefly by growing plants from cuttings obtained from healthy trees in very severely-affected areas, and from diseased trees occurring in good areas. In this way it is hoped to isolate strains of very resistant and very susceptible types for general plantation trials. Such resistant strains should prove advantageous when multiplied vegetatively for use in general plantation work. Attempts at vegetative propagation for this purpose have been commenced.

Mechanical Factors in Relation to Fused Needle Disease.

Consideration was given to the mechanical influence which might be causing the abnormality. It was thought that the exudation of resin which is commonly seen on severely affected trees might, by its glueing action on the bud scales, be hindering the bursting of the buds. In order to try and reproduce this effect, dormant buds of twelve trees of *Pinus carïbœa* and twelve *P. tœda* were well soaked, *in situ*, in a solution of resin and turpentine several times before the spring growth commenced, and were allowed to harden off. The treatment had no effect on the growth of the buds, which, although delayed several days after neighbouring trees had commenced to elongate, grew quite normally.

It has also been considered that the twisting of the needles might be due to an osmotic effect brought about by a low sugar concentration in the cell sap, which would hinge upon the correctness of the carbohydrate hypothesis, which will be propounded later.

IV. INVESTIGATION OF SOIL FACTORS IN RELATION TO FUSED NEEDLE DISEASE.

At the commencement of fused needle investigations in Queensland (Young, 1935) and New South Wales (Ludbrook, 1937-39) the possibility of the trouble being due to some soil factor was considered and investigations have been carried out in this regard. Other studies concerning the relation of soil conditions to the growth of *Pinus* have been undertaken by Kessell and Stoate (1938) in Western Australia. Work along these lines in Queensland proved the most profitable of any of the fused needle investigations. The results will be discussed under the following headings:—

Physical condition of the soil.

Soil deficiency in major elements.

Soil deficiency in minor elements.

Soil organic matter.

Soil manuring experiments with special reference to phosphate status.

Physical Condition of the Soil.

The soils in which trees exhibiting fused needle disease occur exhibit a wide variety of physical types. The trouble has been noted on coarsely-granular granite sands, on sandstone gravels, on soils of both a coarse and a fine sandy nature, and on stiff clays. It occurs on the deep pumice soils of New Zealand and on the deep dune sands of Fraser Island in Queensland, and on the badly-drained heaths of England and the shallow soils of the ridge-tops of the Glasshouse Mountains areas in Queensland. Affected trees are frequently noted in swamps with saturated soils in Queensland and on dry, rocky outcrops with little soil. The soil constituency may vary from the crumb structure of red basaltic loams to the heavy plastic black-soil clays and the free sands, but still the disease occurs. It will, therefore, be seen that the disease is one which is not primarily connected with the physical nature of the soil.

Mechanical analyses throw no light on the subject, although carried out on soils from a considerable number of sample sites.

Experimental work involving cultivation of the soil was carried out at Beerwah (blocks K and L) and Glasshouse Mountains (block M). The results of these treatments, which consisted of tillage of the soil in affected areas to a depth of 5 inches, may be seen in the graphs illustrated in the next instalment and may also be studied in Tables VIII. to XIV., inclusive. The results obtained showed that tillage induced no special response, but gave a similar effect to that obtained by keeping the ground surface clean by removing all vegetation. This effect showed an advantage as regards moisture retention in abnormally dry times, but produced a reduction in growth, together with an increase in fused needle disease in a normal year.

Soil Deficiency in Major Elements.

Whilst investigating the pedological aspect of the problem, a considerable number of chemical analyses of soils, on which fused needle disease occurs and on their counterparts which produce healthy tree-growth, have been made. In no case where analyses for available nutrients only were carried out do the results obtained from soil samples taken from areas carrying a diseased pine population show any significant difference to the results obtained from samples taken from comparable sites carrying a healthy development of pine trees. A table illustrating the results of twenty such analyses appears in a previous paper (Young, 1935). A further number of similar analyses have been made since then, with similar results. Material consisting of badly-affected and healthy pine plants growing on the same site has also been analysed by the Queensland Agricultural Chemist, the samples being obtained from both *Pinus tæda* and *P. caribæa* at Beerwah. No significant differences were observed between the proportions of Ca, Mg, K, P, Fe, Al, Mn, Si, or B in the specimens. Applications of dressings of chemicals containing the usual major essential elements—viz., Ca, Mg, K, P, Fe, S, and N—to a series of individual trees in field plots resulted in totally negative results, and it was at first thought that the possibility of there being a primary deficiency in any of these elements could be eliminated.

The pH value of a number of sites has been determined and found in the Beerwah district to vary from 5·4 to 6·3 without any correlation being found to exist between any particular pH range and the incidence of the disease. A similar result has been obtained by Ludbrook. It has been shown that *Pinus tæda,* under controlled conditions, grows healthily right through the range indicated (Addoms, 1937).

The randomized distribution of affected trees, together with their irregular occurrence in any age class, would also appear to indicate that no particular deficiency of any of the essential elements in the soil make-up is primarily responsible for the onset of fused needle disease, although such a deficiency might, when combined with some other variable factor such as organic matter or individual susceptibility, be a major cause.

Later in the investigations, it was found that the application of phosphatic materials, in certain broadcast fertilizer trials to be discussed later, gave a definite response, and the phosphate distribution in plantation soils was investigated in greater detail. In making this survey two sites, one healthy and one subject to fused needle, were taken for examination. The available phosphoric acid expressed as citric acid soluble is given in Table IV. The samples were collected, ten from each site, to a depth of 8 inches and the analyses were carried out by the Agricultural Chemist. Other than the difference expressed by the growth of the pine trees the two sites were identical and had both carried a well-developed eucalyptus forest before clearing.

TABLE IV.

MEAN AMOUNT OF AVAILABLE AND TOTAL PHOSPHATE PRESENT IN TWO SAMPLE AREAS.

Condition of Trees.	Available P_2O_5 p.p.m.	Total P_2O_5 p.p.m.	No. of Samples.
Healthy	26	135	10
Diseased	44	80	10

Previous to planting with *Pinus tæda*, both areas had been used as pineapple farms. On the healthy site, excellent results were obtained from the trees with reference to both growth and general health, whereas, on the other site, a comparatively high proportion of needle fusion has developed. The pH values determined from all the samples were similar and varied from 5·6 to 5·9. The remaining elements for which analyses were made—namely, K, Ca, Mg, Mn, Al, Fe, and N—were shown to be uniform in their distribution over the two sites. From the results obtained it will been seen that the actual amount of available phosphate is not the limiting factor in the selection of a good planting site, because in this instance the site which proved to be the worst from a disease point of view, contained more than the better site. This was probably due to the manuring activities of the pineapple farmers, who had been the previous occupants of the two sites in question. Analyses of other areas in a similar way have not demonstrated any significant differences in the amount of citric acid soluble phosphate present.

Estimations made of the total phosphate content (20 per cent. HCE extract) of soils supporting healthy and diseased plants have, however, shown very significant differences. On referring to Table IV., it will be seen that the healthy trees grew in a soil containing 135 parts per million total phosphate, while the diseased ones grew in soil containing 80 parts per million. Further investigations regarding total phosphate content of the plantation soils have yielded highly significant results, which will be more fully discussed under the heading of soil phosphate treatments.

The phosphate content of soils which support healthy *Pinus tæda* in Queensland appears to be in the region of 130 to 150 p.p.m. With values in this region an occasional diseased tree is found, but growth on the whole is good. With values below this the disease becomes more evident. *Pinus caribæa* appears to be able to grow healthily with phosphate values as low as 110 p.p.m. For *P. radiata*, in Western Australia, Kessell and Stoate (1938) have found that a minimum amount of 400 p.p.m. of P_2O_5 in the surface soil is necessary for healthy growth. Amounts as low as 300 p.p.m. may be satisfactory if present for a depth of two to three feet. For *Pinus pinaster*, 150 p.p.m. in the surface and sub-surface soils is considered a minimum. The soils at Beerwah and Glasshouse Mountains, in Queensland, which carry stands of *Pinus tæda* and *P. caribæa* definitely affected with malnutrition abnormalities, contain on the average 83 parts per million and vary from 27 p.p.m. to 114 p.p.m. in the top eight inches of soil. Untreated soils in the same area carrying more healthy stands, have total phosphate values of over 110 p.p.m. This value is, however, only on the borderline as regards health, since these stands contain some affected trees.

It would appear that the total phosphate requirement of *Pinus tæda* and *P. caribæa* is less than that of *P. radiata*, and somewhat similar to that of *P. pinaster*. It seems probable that the relative non-susceptibility of *P. pinaster* to fused needle disease in New South Wales and England, when compared with *P. radiata* and *P. muricata*, is connected with its lower phosphate requirement. In a recent publication by Mitchell (1939) it has been shown that with white pine seedlings, the growth response to various concentrations of phosphorus may be divided into the following ranges: From 0 to 50 p.p.m., the region of minima; from 50 to 200 p.p.m., the working region; from 200 to 400 p.p.m., the region of tension; and with greater supplies, the toxic region. These experiments, however, were carried out in the absence of any fungus symbiont.

At Pechey, in Queensland, on a red volcanic soil, with a mean total phosphate value of 2,400 p.p.m., occasional trees affected with fused needle occur in *P. radiata* and *P. tæda*. It is considered that in this instance the effect is due to an organic matter shortage which occurs in young stands in this comparatively dry zone, where the rainfall is 30 inches per annum. When the organic matter supply increases with age, vigorous pine growth results.

The failure of trees treated individually with superphosphate to respond in the experiments mentioned earlier, is attributed to the unsatisfactory nature of the method of application. It is now considered that individual tree treatments in the plantation are unsatisfactory for experimental purposes, and that block treatments are the only suitable method. It has been found by root system dissections in Queensland that the feeding roots of the pine trees are chiefly in the outside area of the radius of root spread, which may be up to fifteen feet, with an eight-foot high tree under Beerwah soil conditions. The feeding roots are thus found to be under neighbouring trees rather than the tree in question. The application of chemicals or other manures around the base of any particular tree is thus seen to be of limited value in so far as that particular tree is concerned, and the negative results obtained from such applications are explainable on these grounds. The relatively poor response obtained from phosphate treatments in this manner and also those obtained by Ludbrook (1938) are attributed to this cause. This method of application was abandoned by the writer in 1935 in favour of broadcast, block treatments in order to reach the root system of all trees within the experiment.

Soil Deficiency in Minor Elements.

The possibility of a deficiency in any one of the minor elements being a direct cause of fused needle disease appeared to be unlikely owing to the random distribution of the affected trees and also because of the variety of soils on which the disease occurs in Queensland and elsewhere. Nevertheless, a considerable amount of experimental work in relation to minor element deficiencies in *Pinus* has been carried out in Western Australia, Queensland, and New South Wales.

In Western Australia, Kessell and Stoate (1938) obtained a response to zinc when this element was used as a spray on rosetted trees. The treatment has been shown by these authors to cause relief from the diseased condition.

Another series of experiments carried out in Western Australia with *Pinus radiata* also resulted in somewhat similar effects (Hearman, 1938). In this case unthrifty trees were treated externally by pouring solutions of ferrous sulphate, nickel chloride, zinc chloride, manganese sulphate, cobalt chloride, copper sulphate, and boric acid over the foliage and bark. The only treatment which gave any response was zinc, which caused vigorous and healthy growth. The negative results obtained by the majority of the salts were investigated further by injection methods. The salts used in this case were zinc sulphate, nickel chloride, manganese sulphate, ferrous sulphate, sodium molybdate, cobalt chloride, boracic acid, and copper sulphate, and were all introduced in solution into the trunks of the trees. The results obtained showed that all the salts used with the exception of copper sulphate, caused vigorous and healthy growth. This indicates that the other salts can, when applied in a suitable manner, take the place of zinc, which therefore is not *per se* a deficient element, but in common with the other elements used, acts as a stimulant. Spectrographic analyses of the salts indicated that they were not contaminated so as to cause false results.

TABLE V.

THE EFFECT OF ZINC SULPHATE SPRAY ON FUSED NEEDLE DISEASE IN *P. tæda*.

Date.	Primary Fusion.	Other Types.	Total Fusion.
	Per cent.	Per cent.	Per cent.
6–10–36 ..	31·5	3·58	34·4
28–1–37 ..	30·0	2·15	39·4
14–7–37 ..	39·4	7·15	46·5
18–7–38 ..	40·4	8·60	49·0

Following on the experiment of Kessell and Stoate with zinc sprays, an experimental plot was designed at Beerwah (Queensland), in a stand of *Pinus tæda*, of which 34·5 per cent. of the trees were affected with fused needle disease. One hundred and forty trees were included in the plot, and the spray was applied by means of a knapsack spray, to trees ranging up to twelve feet in height. The spray mixture was made up according to the following formula:—

Zinc sulphate, 10 lb.; hydrated lime, 5 lb.; and water, 100 gallons.

The first treatment was applied to the trees on 6th October, 1936. A second treatment was given on 28th January, 1937, followed by a third application on 25th March, 1937. All the treatments were applied during the period of active growth of the trees. Forty gallons of the spray mixture were used at each application. The observations made during the course of the experiment are illustrated in Table V.

The results signify that treatment of *P. tæda* during the growing season with the zinc spray gave negative results as regards its effect on needle fusion. The percentage of affected trees in the experimental plot varied directly, as did that in a control plot adjoining the treated area—that is, there was a steady normal increase in the incidence of the disease during the course of the experiment. Observations taken in 1938 showed that there was no delayed response.

Copper is also known to act as a plant stimulant under some conditions (Jacks 1938), and it was decided to carry out a comprehensive treatment with this element involving a number of trees. The experiment consisted in the treatment of a block of sixty trees of *Pinus tæda* at Beerwah with a broadcast dressing of the soil surface with copper sulphate at the rate of three hundredweight per acre. The results obtained over one growing season are shown in Table VI.

TABLE VI.

THE EFFECT OF COPPER SULPHATE ON FUSED NEEDLE DISEASE.

Treatment.	Mean Height (1938).	Mean Height (1939).	Mean Girth (1939).	Per cent. Diseased Trees (1938).	Per cent. Diseased Trees (1939).
Untreated ..	13·35	14·68	7·95	81·0	86·0
Treated ..	13·5	15·33	8·08	75·0	62·2

The results of the experiment indicate that there was a reduction in fused needle in the treated plants and an increase in height growth. The treated plants were clothed with foliage of a deeper colour than that of the untreated ones. The indications were that copper sulphate treatment caused a stimulus to the growth of affected *Pinus tæda.*

A series of single-tree treatments with a number of the minor elements was carried out on *Pinus tæda* at the Beerwah plantations in 1934. The elements used were Cu, B, Zn, Mn, Ni, Al, and Co. The elements were applied as salts to the soil around the base of the trees, where they were worked in. No response was obtained from any of the elements when applied in this way.

In New South Wales, Ludbrook (1939) has used a very extensive range (37) of these elements, including silver, both in mixture and singly, with similar results to those obtained in Queensland, except that indications of some response have been given by boron. No positive results were obtained by him when he used the chemicals in injection methods of tree treatment, save for an inconclusive response which was given by boron in this series also. Spectroscopic analyses of needles which were carried out for him have shown no significant differences for boron content in the needles of healthy and diseased trees. In

England, Jones (1938) has found that spectroscopic analyses of healthy and diseased pines, from Wareham, in Dorsetshire, have indicated that there is a lower boron and zinc content in affected trees than in healthy ones.

The collection of samples of plant material for analytical purposes in regard to fused needle of *Pinus,* is a matter of some complexity. It has been shown above that individual trees vary in their reaction to the factors which cause the disease, some becoming typically fused, others showing some one or other of the other abnormalities described. It seems that all the trees from any one affected area are suffering from some form of the condition and that the collection of material from any of the trees whether typically fused or not, would show little difference when analysed. This factor may explain the results obtained by Ludbrook and the writer, when analyses of such material have been carried out. It must not be lost sight of that a deficiency of an element in the soil and its consequent relative deficiency in the plant ash may not actually mean that the plant is suffering any inconvenience from the lack of that particular element.

It is of interest to note that in citrus orchards in districts adjacent to Beerwah, and on similar soil types, the physiological disease exanthema has been known to be prevalent. Exanthema is considered to result from a copper deficiency, and accordingly, this element may be present in a low amount for the pine trees also. In Western Australia, on soils of a different derivation, it would seem that from the results obtained by Kessell and Stoate, and Hearman, the possibility of a copper deficiency can be ruled out. There is, however, a likelihood of there being a deficiency in zinc or other elements, the treatment of pine trees with which gives no results in Queensland or New South Wales.

The response to zinc treatment obtained by Kessell and Stoate (1936) is perhaps partly explainable along the same lines as the theory concerning the cause of pecan rosette put forward by Woodroff (1933). In this publication it is deduced that the beneficial results obtaining after the treatment of rosetted trees with zinc salts are possibly due to the promotion of normal mycorhizal activity. In the rosetted condition the root-fungus structures are in the form of pseudo-mycorhizas, and are apparently harmful due to the feeble resistance of the tree to the fungal infection. A similar explanation of the cause of mottle leaf in citrus has been suggested by Rayner (1933), and investigated by Reed and Frémont (1934) in California, and it is thought that the curative effect of zinc in the absence of humus mulching is possibly due to a root stimulating action.

Opinions still differ as to whether the stimulatory action of copper when added to soils supposedly deficient in this element is a physiological one or due to a chemical reaction in the soil itself. The best known copper deficiencies are on peaty soils, and in the case of reclamation disease, Smith (c.f. Jacks, 1938), isolated from affected soils a crystalline substance which caused reclamation disease when applied to plants and which was precipitated by copper salts. Vieschlag (c.f. Jacks, 1938), observed that substances toxic to plant growth in peat soils could be rendered non-toxic by applying copper sulphate or nitrate. In Europe, copper deficiency has been reported almost solely from heath regions. Needle fusion in England has as yet only been reported from such a soil in

Dorsetshire, but in Australia occurs on other types which are principally sandy in nature.

Work carried out in Russia (Sovietski Subtropiki, 1938), has shown that boron and phosphorus and boron alone increase the chlorophyll content of citrus leaves when used in small amounts. In larger amounts boron alone and boron plus phosphorus decreased the amount of chlorophyll. Manganese, zinc, and copper both separately and with boron increased the chlorophyll content. The greatest increase was with zinc alone, the least with all four elements. These results accord well with the writer's hypothesis for a carbohydrate deficiency basis for the abnormalities in *Pinus* which are discussed here. The stimulus to chlorophyll production provided by the minor elements would result in increased carbohydrate formation in all the leaves. This would, to some extent, offset the root deficiencies which are shown later to exist in the case of fused needle trees. The treatment with copper sulphate carried out by the author caused a greener appearance of the affected trees and stimulated growth. The results obtained by Kessell and Stoate, and Hearman, conformed to the Russian plan. It would appear likely that the stimulatory effect of the minor elements on the pine trees in all cases described could be largely due to a chlorophyll increase, such as was noted in citrus in Russia. The root stimulus and soil conditioning effect may be present to a subsidiary extent.

It has been suggested by Willis and Piland (1936) that minor elements and organic matter may affect crop yields by a catalytic influence on oxidation-reduction reactions, and by that means, on biological activities. It has also been shown by the same authors (1938) that in a muck soil the application of copper sulphate by catalysing an oxidative process was able to bring about a response to phosphorus. It is possible, therefore, that the effect produced by copper sulphate in the experiment at Beerwah which is described above may be ascribed to this reaction rather than to a direct copper deficiency.

Soil Organic Matter.

Whilst surveying and comparing badly affected and healthy plantation sites for the purpose of obtaining any correlations between observable site peculiarities and the incidence of fused needle disease, attention was paid to the occurrence of soil organic matter. As mentioned previously, it was considered very early in the inquiry that mycorhizal relations had some bearing on the trouble. It is well known that the production of healthy mycorhizas depends to a large extent on an adequate supply of soil organic matter (Melin 1925, Rayner 1927), and the fused needle affected areas were examined from this point of view. It was noticed on sites where there was an abundant development of leafy undergrowth that the disease was rare. It was found that the development of this type of undergrowth could not be correlated with any obvious soil features differing from neighbouring sites where fusion was rife. The disease was also found to be relatively absent from plantation areas where a pine litter was forming, due to the production of a canopy of pine branches at the closing of the stand.

At first, attention was paid to the actual organic matter content of the soil itself, excluding the surface litter, but later it was considered that the latter was just as much if not the more important of the two.

A number of samples of soil were collected on Fraser Island from beneath healthy and diseased trees growing on a white marine sand. Another series of samples was collected at Beerwah from beneath trees showing similar effects. All samples were taken to a depth of six inches and excluded the surface litter. The total carbon content of all the samples was determined by the Agricultural Chemist, resulting in the figures shown in Table VII.

TABLE VII.

TOTAL CARBON ESTIMATION IN SURFACE SOIL BENEATH DISEASED AND HEALTHY TREES.

Condition.	Locality.	No. of Samples.	Total Carbon.
			Per cent.
Healthy	Fraser Island ..	5	0·7
Diseased	Fraser Island ..	6	1·17
Healthy	Beerwah	10	1·21
Diseased	Beerwah	10	1·12

The results indicate that the actual quantity of carbon present in the soil itself has little bearing on the incidence of the disease, but do not exclude the possibility of the composition of the organic matter being an important factor.

It has been shown by Heyward and Barnette (1934) that the total organic matter in the top six inches of the soil is actually increased in frequently fired stands of *Pinus caribæa* and *P. palustris* in the United States of America on similar soils to those at Beerwah. However, the feeding root system in this layer of the soil, which is very important in pine nutrition, was adversely affected by the chemical and physical changes brought about by the burning. This may explain the excess of carbon in the soil obtained from beneath diseased trees on Fraser Island which occurred in comparatively recently burned areas, as compared with that in soil from beneath healthy trees on older areas which had had time (over twenty years) to recover from fire effects. In any case observations have shown that, in areas in which fused needle occurs, the threshold between health and disease is very narrow in the case of a number of trees, as evidenced by their change from the healthy to the diseased condition, followed by their recovery, on several consecutive occasions. From this point of view it will be seen that soil samples from below individual trees in any one area where infection occurs are likely to give inconclusive results on analysis.

It has been noted on Fraser Island that the clearing and burning of the rain forest which exists on this marine sand was followed by a reversion of ecologic vegetational type to the heath condition and that species of *Pinus* planted on those cleared areas were early affected with fused needle but after approximately twenty years tended to recover. As time goes on the felled and burned areas on the sand gradually pass through all stages of succession until the rain forest type is again reached, as a result of the *Pinus* producing a complete canopy. It is at this stage that the fused needle trees recover from the disease and commence healthy growth. The changes which have taken place in the soil during the progress of the succession are mainly accounted for by the formation of a duff layer on the soil coinciding with the return to a condition of canopy, and it cannot but be felt that this is also directly connected with the immunity to fused needle disease acquired by the pines with this development.

The area most severely affected with fused needle at Beerwah is on a soil type which is almost identical with other types on the same plantation which, however, support healthy pine growth. One difference only between this and the other similar sites is that the area is adjacent to the railway line and, until protected, was subjected to fires at much more frequent intervals than were locations further from the railway. In fact, this area had the worst fire history in the plantation.

It has been noted above (Heywood and Barnette 1934) that frequent fires have an adverse effect on the soil structure both chemically and physically in the top four to six inches of the soil in the longleaf pine region of the United States. The observations of these authors point out that in fire-affected soils the surface horizon becomes impermeable and extremely compact as a result of exposure to the sun and driving rains and that the evidence of an active macro-fauna is rare. They also noted an absence of feeding roots of the pines in the surface layers of the soil on affected areas, whereas in unburned areas these feeding roots had actually worked their way well into the duff layer which, of course, was absent on the burned soils. A similar state of affairs prevails in the fused needle affected areas in Queensland, and is particularly noticeable in Block K, the area just described. It can only be concluded that fire has played some part in the development of the abnormal condition in this area. Another area in which is situated Block B, referred to in connection with phosphate treatments, has had a somewhat comparable fire history. This block developed more fused needle than a similar type which has been less affected by fire, notwithstanding the fact that the soil of the latter had a lower content of available phosphate.

The occurrence of a relatively low percentage of fused needle affected trees on sites in the plantations at Beerwah which support a heavy covering of blady grass (*Imperata cylindrica* var. *kœnigii*) has been noted by several observers, but it is not found possible to correlate these phenomena in every instance. It is thought, however, that the blady grass supplies sufficient ground cover in the way of shade and litter to parallel the development of rain forest on the Fraser Island sands and thus supplies a medium on the soil surface suitable for the development of the short-rooted surface feeding system of the conifers.

The deficiency of suitable litter appears to be an important factor in the occurrence of fused needle disease at Pechey, in Queensland. Here the *Pinus* plantations are located on a rich soil with total phosphate values of over 2,000 p.p.m., but with a low soil moisture content. This paucity in soil moisture militates against the development of the litter layer suitable for mycorhizal development.

[TO BE CONTINUED.]

CHANGES OF ADDRESS.

Subscribers are asked to kindly notify changes of address to this Department without delay.

Variations in Milk Tests.

E. B. RICE.

VARIATIONS which occur from time to time in the fat content of milk sometimes cause misunderstanding amongst suppliers to cheese factories. It is the purpose of this paper to deal with a number of factors which can influence the percentage of fat—the most variable of milk constituents—in order that producers may understand something of the many conditions which can have a bearing on fat tests. Unfortunately, although the general effect of many factors is understood, very little research has been carried out so far in Australia to determine their exact influence under local conditions. According to their mode of causation, the differences which occur in the fat content of milk may conveniently be placed into two main divisions:—

A.—Natural or inherent causes.

B.—Other causes.

A.—Natural or Inherent Causes of Variation.

A further subdivision of the above may be made under the following headings:—

(1) Breed.

(2) Individuality of the Cow.

1. *Breed.*—This is the most important factor influencing the percentage of fat in milk, it being well known that cows of certain breeds are noted for high fat content. For instance, Jersey and Guernsey milks are usually richer than that of Friesian, with Australian Illawarra Shorthorn and Ayrshire intermediate between them. Within any one breed, however, certain families will be found to give milk above average quality for the breed, while others will be below the average. It is usually found that continual crossing of breeds tends towards a depreciation of fat content. From figures kindly made available by Mr. A. K. Henderson, Inspector of Dairies, Toowoomba, who for many years has supervised the Ground Milking Competitions for the Royal Agricultural Society, Toowoomba, an analysis has been made of the fat content of cows of different breeds which have competed in these competitions for the years 1929-1939, both inclusive. The mean fat percentages determined on separate samples of both night's and morning's milk are tabulated below:—

Breed.	Average Fat Percentage.	Number of Cows Tested.
Jersey	5·27	35
A.I.S.	3·99	146
Ayrshire	3·96	14
Friesian	3·50	5

It should perhaps be mentioned that although cows of a particular breed may usually yield milk richer in fat than the cows of another breed, it does not follow that the total quantity of fat in the milk yielded by an individual cow of the former breed will exceed that in the milk of a cow of another breed, which may produce a larger quantity of milk with a lower fat test. Furthermore, irrespective of breed, the objective of any progressive breeding policy is to produce animals which give a relatively high daily yield of milk and butterfat over a lengthy lactation period every year rather than cows which may yield well for a few months after calving, but which rapidly decline in production as the lactation period advances.

2. *Individuality of Cow.*—Fat being an hereditary characteristic, there are often wide differences in the milk of individual cows of any particular breed. In order, therefore, to maintain and, if possible, to improve the fat production of the whole herd it should be the aim of every dairy farmer to carry out systematic herd testing with a view to identifying the cows which yield a low test and low total fat return, culling them from the herd as opportunity presents itself and using for replacement heifers from high-producing stock. Equal importance must be attached to the herd sire, for the deteriorative influence of an inferior bull will soon be reflected in a decline in the productive capacity of a herd. In Denmark the pursuance for many years of an enterprising policy of improvement of the native cows—Red Danish Breed—by breeding only from cows combining high yield with high fat content and prepotent bulls of superior quality has been a strong factor in enabling the dairy stock of that country to reach their present high standard of milk and fat production.

Although the milk of some cows shows fluctuating fat tests from day to day, generally there is not a great daily difference in the bulked milk of a herd.

As progress is made in the science of genetics, so will the present meagre knowledge concerning the inheritance of milking qualities in dairy stock be extended.

B.—Other Causes of Variation.

Apart from the inherent or natural causes, the chief factors which are deserving of mention are—

(1) Stage of lactation.
(2) Season of year, temperature, and weather conditions.
(3) Excitement and œstrum.
(4) Efficiency of milking.
(5) Interval between milkings.
(6) Health.
(7) Exercise.
(8) Age.
(9) Feeding and condition of animal.

1. *Stage of Lactation.*—In this State where almost all the cows in the herd calve at approximately the same period of the year (spring), this is a most influential factor in causing the fat content of the bulked milk to vary from time to time. It may be taken as a general rule that cows produce milk of higher than normal fat content for about a fortnight after calving, followed by a gradual reduction in the fat test until it reaches its lowest level about the time of maximum milk yield—that is, three to four months after calving. It then remains fairly stationary

for some time, but a higher fat percentage will be recorded again when the end of the lactation period is approaching and the milk yield is declining to its lowest quantity. Perusal of numerous test records at cheese factories has confirmed this under Queensland conditions. In this State the period of minimum fat content in the lactation cycle coincides with the hottest months of the year and, as high temperatures are also known to reduce the fat content, it can readily be understood why milk tests are at their lowest at this time of the year.

2. *Season of Year, Weather Conditions and Temperature.*—Temperature, weather conditions, and season of year are so closely interrelated in Queensland that they may be considered together. Because of their possible effect on certain other factors, it is difficult to ascribe a clear-cut result to them, but in England and America some experiments designed to furnish information respecting weather and temperature have been made by controlling, as far as practicable, all other conditions.

Temperature has been shown to exert its influence by causing richer milk to be secreted at lower temperatures and milk of lower fat content at warmer temperatures, about 50 degrees F. being the optimum. Similarly, the fat content is lower in summer and higher in winter. Perusal of butterfat test records at a number of Queensland cheese factories has revealed the difference between January and June tests to be about 0·3 per cent. The average tests for January and May, respectively, for several years at the six factories of the Pittsworth Co-operative Dairy Association, representing about 120 suppliers, are given below:—

Month.	Mean Test for All Suppliers.	Month.	Mean Test for All Suppliers.
	Per Cent.		Per Cent.
January, 1925.. ..	3·68	May, 1925 ..	3·99
January, 1926.. ..	3·62	May, 1926 ..	3·98
January, 1927.. ..	3·69	May, 1927 ..	3·88
January, 1936.. ..	3·59	May, 1936 ..	4·04
January, 1938.. ..	3·64	May, 1938 ..	3·90
January, 1939.. ..	3·66	May, 1939 ..	3·79

There is little evidence as to the actual effect of *sudden changes in weather conditions,* as other accompanying factors—food supply, water, exercise, &c.—often disturb the fat content and especially the total yield of milk. For instance, it is usual to change cows from green, succulent feed to dry paddocks during *rain,* and it has been observed that often there is a diminution in milk yield and a sudden appreciable rise in fat content. This is clearly evident from a recent set of figures made available by the Springside cheese factory:—

——	Mean Test.	Quantity of Milk Treated.
	Per Cent.	Gallons.
8-day composite samples (22 suppliers) for period prior to rain	3·6	6,272
8-day composite samples for period in which rain fell	4·1	5,762
8-day composite samples for period immediately after rain	3·6	6,358

Normally, there are *few sudden temperature changes* of a severe nature in this State in the gradual transition from cool to warmer weather, and vice versa, and it is, therefore, to be expected that under our conditions this factor is of little consequence.

Coincident with the dry spell (drought) towards the end of 1938 and at the beginning of 1939 was a period of abnormally hot weather. A slight diminution in the fat content of milk was recorded and the solids-not-fat (especially casein) were considerably reduced. This was repeated in the dry spell from August to October, 1939; because of the scanty pastures and herbage, the solids-not-fat content were greatly depressed. The following table reflects the effect of the former period on the milk tests at the Pittsworth group of factories:—

Month.	Mean Test for All Suppliers.	—
	Per Cent.	
October, 1938	3·70	Normal weather prior to onset of drought and heatwave.
November, 1938 ..	3·76	
December, 1938 ..	3·67	Period of drought and abnormal heat.
January, 1939 ..	3·66	
February, 1939 ..	3·79	Drought broken and normal weather restored.
March, 1939	3·88	

3. *Excitement and Oestrum.*—The cow being a nervous animal, the fat content in its milk may be lowered by any condition which causes undue excitement or nervousness, such as being chased by dogs, subjected to over-exertion in being driven to the milking yards, noise, change from the usual milker, &c.

Sexual excitement, oestrum or "heat" induces varying effects depending upon the individuality of the animal. With some cows there is no appreciable change in the composition of the milk, while in many cases there is a slight rise in fat content, and a slight decrease in milk flow.

The change of environment and other abnormal conditions associated with *showyards*, may cause a marked variation in the percentage of fat. This accounts for the disappointing results given by some cows in showground milking competitions in comparison with their tests under normal farm conditions.

4. *Efficiency of Milking.*—Quick and thorough milking is found to have a marked effect on the quantity and richness of milk, sometimes as much as 30 per cent. more milk being yielded by a cow milked by an efficient milker, compared with an unskilled worker. Thoroughness means careful stripping out of each cow, for the strippings sometimes contain twice as much fat as the remainder of the milk. Not only is there a diminished yield and decrease in fat content by incomplete stripping, but, if continued, the practice contributes to the more rapid drying-off of the cow.

A change from the usual milker may cause a drop in the fat content of an individual cow.

5. *Interval Between Milkings.*—The wide divergence which may be noted between the fat content of evening and morning milk is familiar to farmers who have entered cows for advanced registry or grade herd recording purposes. The cause of this variation—the interval between

milkings—constitutes the most important factor in the differences which occur in the fat content of the milk of an individual cow. It is usual for the morning's milk, produced after the long night's interval, to be of greater quantity and lower fat test than the evening's milk. The difference between the fat content of the milk obtained at the two milkings may be as great as one to two per cent., if the periods between milkings are very irregular—for example, if milking is done at 4 p.m. and 6.30 a.m., giving an interval between night's and morning's milk of 14½ hours, and between morning's and night's milking of 9½ hours. Data collected from the results of the 1939 ground milking trials at the Toowoomba Show is set out hereunder:—

NUMBER OF COWS TESTED 43. MILKED AT 6.0 A.M. AND 4.30 P.M.

Number of Cows Tested 43.	Milked at 6.0 a.m. and 4.30 p.m.	
	Mean Weight.	Mean Fat Test.
	Lb.	Per Cent.
Morning milk	19·3	4·30
Night milk	16·4	4·88

The following figures for two competing cows illustrate the degree of variation from the mean which may occur in individual cases:—

Cow No. 1.

——	Weight of Milk.	Fat Test.
	Lb.	Per Cent.
Morning milk	32·5	3·7
Night milk	27·5	5·9

Cow No. 2.

——	Weight of Milk.	Fat Test.
Morning milk	14·3	3·9
Night milk	12·1	6·0

Although the main trend for yields and fat tests is in the direction just indicated, the writer is aware of a farmer on the Downs, who invariably milks very early in the morning, and after dusk at night, thus reversing the usual order, and who, consequently, obtains a greater quantity of milk of lower fat test in the evening.

It should thus be obvious that any supplier who sends samples to a laboratory, or other place, for check testing must be careful not to select just morning's or night's milk as a check against the factory test. At factories a representative sample of the mixed night and morning milk is taken, and it is therefore essential for the farmer to take a true sample of the mixed milk if he is not to be dissatisfied because the results obtained from his sample are at variance with the factory tests. Likewise, some farmers, in order to obtain butter for household purposes, habitually skim some cream from the evening's milk prior to dispatch to the cheese factory next morning. The effect of this practice in decreasing tests must also be borne in mind if a sample of unskimmed milk be forwarded for check purposes.

6. *Health.*—The fat content is subject to alteration if an animal be indisposed, if recently calved, if the udder receives a chill, or if any other abnormal condition arises.

(*a*) *Mastitis.*—Milk from animals with diseased udder (mastitis) is often of abnormal chemical composition and may continue to be so even after the udder appears normal. Mastitis milk, which often is unusually low in solids-not-fat content (chiefly casein), may cause great difficulty in cheese-making. Some samples of milk from mastitis-infected cows recently analysed, have given the following results:—

Sample No. 1.
(Disease in advanced stage).

	Per Cent.
Fat	1·3
Casein	2·0

Sample No. 2.
(Disease in less advanced stage than No. 1).

	Per Cent.
Fat	2·3
Casein	1·9

(*b*) *Three-Day Sickness* (*Ephemeral Fever*) *and Drought.*—In the period just prior to the breaking of the drought in March, 1937, and during the incidence of three-day sickness (ephemeral fever) in the dairy herds of the State, cheese factories were having much difficulty owing to the abnormal chemical composition of the milk supplies then being received. As an example, the bulk milk supply at one factory was found to have the following composition:—

	Per Cent.
Fat	3·8
Casein	1·7 (normally 2·5 per cent.)

The extent to which each of the above factors operated in causing such abnormal composition cannot, of course, be estimated. Since, however, cheese yields bear a direct relationship to the casein content of milk, factories were naturally obtaining very low cheese yields from the milk treated during this period.

(*c*) *Colostrum.*—For the first five days after calving, the milk of the cow is of abnormal chemical composition, showing very high figures for albumin and total solids, and comparatively low fat and sugar. The undermentioned analytical figures for a sample of colostrum submitted to the laboratory and normal milk of the same fat content reveal clearly the differences in composition.

——	Colostrum.	Normal Milk.
	Per Cent.	Per Cent.
Fat	3·5	3·5
Milk sugar	3·0	5·0
Casein	2·6	2·4
Albumin	16·5	0·5
Total solids	26·9	12·5

7. *Exercise.*—Obviously, under Queensland conditions, where cows are out at pasture day and night throughout the year, they at all times receive ample exercise, and this factor need hardly receive mention. However, in some European countries, cows must remain continuously indoors for seven to eight months every year, and there is little opportunity for exercise. Experiments have demonstrated that there is a slight increase in the fat content if the cows are exercised, and a

decrease if changed from exercise to rest. The experimental animals were walked three miles a day for exercise. Although milk production was maintained, and the fat percentage slightly improved by exercise, the greater food consumption, especially as hand feeding had to be resorted to in such countries during the period in which the cows were kept in the sheds, more than offset any gain by the increased fat content in the milk.

8. *Age.*—The fat content of milk does not alter to any appreciable extent with age, except that between three and five years there is a slight increase and a slight decrease in advanced years. In the milk of a whole herd this factor is unlikely to exert any bearing on the fat content of the bulked milk. It may be remarked that normally, if a heifer produces milk of low fat test in her first lactation period, it cannot be anticipated that the milk will be richer in subsequent lactations, for the capacity to produce rich milk is an inherited characteristic. The quantity of milk yielded will, of course, increase with age until the maximum yield is reached at about seven years of age.

9. *Feeding and Condition of Animal.*—These closely related matters may be grouped together. Contrary to the opinion of many farmers, the conclusions reached from numerous investigations carried out in various countries are that, in herds of cows receiving an adequate and balanced ration, changes in feeding can, at most, cause only a slight and temporary change in fat content, and a permanent alteration cannot be induced by this means.

An authority on dairy husbandry in England, Mr. J. Mackintosh, of the National Institute for Research in Dairying, University of Reading, has the following to say concerning the effects of kind and quality of food on the fat content of the mixed milk of a herd[1].—

(*a*) *Continuous underfeeding* produces less milk of a slightly lower fat content than some cows would yield under adequate feeding.

(*b*) *Continuous over-feeding* improves the condition and may maintain yield, but does not cause continuous high fat percentage. With herds in high condition, an increase in the protein in the diet (i.e., a change to a narrower nutritive ratio)' may increase the fat percentage for a short time—probably transference of body fat to milk fat is stimulated. Reducing a high ration to a standard amount will also cause a temporary increase in fat percentage, but with a decrease in yield.

(*c*) *Feeding of Special Oils and Fats.*—Temporary increases in fat percentages have sometimes been obtained by giving oils and fats—such as linseed, soya bean, palm nut, coconut, and cottonseed oil. One cannot be sure of such results with all cows, and effects may not be discovered unless the fat percentage is ascertained daily. Some claim that such increases are not due to the oils themselves, but due to abnormal feeding. Some fats also cause decreases—e.g., cod liver oil, used at the National Institute for Research in Dairying, depressed the fat percentage when 6 to 8 oz. were given daily and the depression continued for six weeks.

The effect of cod liver oil on the fat of milk was also confirmed by Dr. Sheehy, of Albert Agricultural College, University of Dublin, with whom I discussed the matter during my trip to Ireland[2].

It is usually conceded that a cow, if well nourished and fit at calving time, will give a better yield in the ensuing lactation period than if she calves in poor condition, and overseas research has shown that a higher fat test will also be maintained.

Acknowledgment.

It is desired to acknowledge the courtesy of Mr. R. C. Duncan, secretary of the Pittsworth Co-operative Dairy Association Limited, who made available results of tests for use in this article.

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CREAM BLENDING.

An examination of cream on the receiving platform of almost any factory will indicate the necessity for careful treatment and storage on the farm. Proper blending of the cream after separation is essential.

The process of cream ripening assists the production of delicate butter flavours.

The development of lactic acid in the cream is desirable, because the lactic acid bacteria, if present in large numbers, prevent the undesirable off-flavours and taints from developing.

Small quantities of cream are more difficult to hold in a satisfactory condition than larger quantities, and, consequently, the dairy farmer should keep his supply in as large a bulk as possible.

Objections to blending have been raised by some dairy farmers, who claim that if the cream from each milking is kept separate, only portion of the supply will be graded second-grade when sent to the factory. To this objection, however, it might be stated that the aim of dairy farmers to-day is, or should be, to have all and not merely part of their cream of the highest "choice" quality.

To blend correctly, the cream from each separation is first cooled for about an hour before adding to the bulk supply, which should always be kept as cool as possible.

If the use of the cooler and aerator has been effective, the cream should then be ready for blending—the farmer must satisfy himself, however, in all cases that the cream is sufficiently cooled before attempting to add it to the bulk.

Thorough and frequent stirring with a metal stirrer is necessary for correct blending.

If two or more cans are to be sent to the factory, approximately equal portions of the cooled cream from each separation should be placed in each can. This will ensure that a standard cream is supplied.

Straight Fertilizers and their Incorporation into Fertilizing Mixtures.

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IT can be claimed justly that the standard of fertilizers sold in Queensland is particularly high—which is confirmed by a review of the fertilizers registered under the Act.

The following sets out the kinds of materials sold and the respective percentages of nitrogen (N), phosphoric acid (P_2O_5) and potash (K_2O) present in such materials:—

Fertilizer.	Minimum.		
	Nitrogen.	Phosphoric Acid.	Potash.
	Per Cent.	Per Cent.	Per Cent.
Nitrate of soda	15·6	..	..
Sulphate of ammonia	20·6	..	..
Dried blood	11 to 13	..	..
Superphosphate	..	*20·5	..
Bone dust	3 to 3·5	22 to 23·5	..
Meatworks fertilizer	3 to 6	14 to 23	..
Basic phosphate	..	†17	..
Nauru phosphate	..	37	..
Sulphate of potash	..	..	48
Chloride (Muriate) of potash ..	..	..	50

* Water soluble. † Citric acid soluble.

A large proportion of the fertilizers distributed in Queensland is sold in the form of mechanical mixtures, i.e., mixtures containing two or more of the abovementioned ingredients (with the exception of basic phosphate and Nauru phosphate) in varying quantities.

In order that the purchaser may be aware of the composition of the various fertilizers, it is enacted by law that the respective minimum percentages of nitrogen, phosphoric acid, and potash, together with the forms in which they respectively occur, shall be declared on the label attached to each bag. This label should also set out the name of the fertilizer, the net weight, and the name and address of the manufacturer or dealer.

Every sale of fertilizer over the value of 10s. must be accompanied by an invoice setting out the warranty required by the Act.

The labels that must be attached to every bag of fertilizer and the invoice warranty which must accompany the sale are the purchaser's guarantee as to its quality.

It is to the intending buyer's advantage to make himself acquainted thoroughly with the constituents of each fertilizer advertised as useful for his purpose before making a purchase.

The Act also requires that if filler be used in compounding a fertilizer mixture, the proportion of this filler used must be stated on the label; this has had such a deterrent effect on the use of filler, that at the present time, none is used in Queensland.

MIXED FERTILIZER CHART BASED ON ONE TON (2,240 LB.)

Per Cent. Nitrogen Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.								Per Cent. Phosphoric Acid Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.						Per Cent. Potash Required in Mixture.	Quantity of Ingredient to be used per Ton of Mixed Fertilizer.			
	Sulphate of Ammonia.		Dried Blood.		*Bone Dust.		*Meat-works Fertilizer			Super (Water Sol.)		*Bone Dust.		Meat-works Fertilizer.*			Sulphate of Potash.		Chloride (Muriate) of Potash.	
	Cwt.	lb.	Cwt.	lb.	Cwt.	lb.	Cwt.	lb.		Cwt.	lb.	Cwt.	lb.	Cwt.	lb.		Cwt.	lb.	Cwt.	lb.
¼		28		46	1	48	1	0	¼		28		24		35	¼		11½		11¼
½		55		93	2	96	2	0	½		55		47		70	½		23¼		22½
1		109	1	75	5	80	4	0	1		109		95	1	28	1		46½		44¾
1½	1	52	2	56	8	64	6	0	1½	1	52	1	31	1	98	2		93		90
2	1	107	3	37	11	48	8	0	2	1	107	1	79	2	56	3	1	28	1	22
2½	2	49	4	19	14	32	10	0	2½	2	49	2	14	3	14	4	1	75	1	67
3	2	104	5	0	17	16	12	0	3	2	104	2	62	3	84	5	2	9	2	0
3½	3	46	5	93	20	0	14	0	3½	3	46	2	110	4	42	6	2	56	2	45
4	3	101	6	75	..		16	0	4	3	101	3	46	5	0	7	2	103	2	90
4½	4	44	7	56	..		18	0	4½	4	44	3	93	5	70	8	3	37	3	22
5	4	98	8	37	..		20	0	5	4	98	4	29	6	28	9	3	84	3	67
5½	5	41	9	19	..		..		5½	5	41	4	77	6	98	10	4	19	4	0
6	5	96	10	0	..		..		6	5	96	5	12	7	56	11	4	65	4	45
6½	6	38	10	93	..		..		6½	6	38	5	60	8	14	12	5	0	4	90
7	6	93	11	75	..		..		7	6	93	5	108	8	84	13	5	47	5	22
7½	7	35	12	56	..		..		7½	7	35	6	43	9	42	14	5	93	5	67
8	7	90	13	37	..		..		8	7	90	6	91	10	0	15	6	28	6	0
8½	8	33	14	19	..		..		8½	8	33	7	27	10	70	16	6	75	6	45
9	8	87	15	0	..		..		9	8	87	7	75	11	28	17	7	9	6	90
9½	9	30	15	93	..		..		9½	9	30	8	10	11	98	18	7	56	7	22
10	9	85	16	75	..		..		10	9	85	8	58	12	56	19	7	103	7	67
10½	10	27	17	56	..		..		10½	10	27	8	106	13	14	20	8	37	8	0
11	10	82	18	37	..		..		11	10	82	9	41	13	84	21	8	84	8	45
11½	11	25	19	19	..		..		11½	11	25	9	89	14	42	22	9	19	8	90
12	11	79	20	0	..		..		12	11	79	10	25	15	0	23	9	65	9	22
12½	12	22	..		..		..		12½	12	22	10	72	15	70	24	10	0	9	67
13	12	76	..		..		..		13	12	76	11	8	16	28	25	10	47	10	0
13½	13	19	..		..		..		13½	13	19	11	56	16	98	26	10	93	10	45
14	13	74	..		..		..		14	13	74	11	103	17	56	27	11	28	10	90
14½	14	16	..		..		..		14½	14	16	12	39	18	14	28	11	75	11	23
15	14	71	..		..		..		15	14	71	12	87	18	84	29	12	9	11	67
15½	15	14	..		..		..		15½	15	13	13	22	19	42	30	12	56	12	0
16	15	68	..		..		..		16	15	68	13	70	20	0	..	..		..	

The above calculations are made to the nearest lb. except with small quantities of the concentrated potash bearing ingredients.

* As bonedust and meatworks fertilizer contain both nitrogen and phosphoric acid, when a per cent. of nitrogen is required a corresponding proportion of phosphoric acid must also be obtained; for instance, to obtain 2½ per cent. nitrogen from a 5/16 meatworks, 10 cwt. must be used, which will also give 8 per cent. phosphoric acid.

In this connection it might be mentioned that in even such a progressive country as the United States of America, a 3-8-3 (grade formula 14) fertilizer mixture is still one of the best selling fertilizers—particularly in certain Southern cotton-growing States—whereas in Queensland, practically no fertilizer mixture having a grade formula of less than 20 is sold.

In order to assist those who desire to calculate the percentage of nitrogen, phosphoric acid and potash in a given mixture, or the quantities of the various ingredients which may be used to compound a given mixture, a table has been drawn up, covering common fertilizers incorporated in mixtures.

Meatworks fertilizer has been included in the table, the value of nitrogen being taken as 5 per cent. and phosphoric acid 16 per cent. As the analysis of the different brands shows a wide variation, this should be taken into account when using the table in relation to meatworks fertilizer.

In connection with the use of this table, it may be here appropriate to give the following words of advice:—

In calculating commercial mixed fertilizers, the ingredients will not always total to the ton. The chief reasons for this are twofold—one is that, although one figure is taken to represent the "active constituent" content of each ingredient in the table given, actually even standardized commercial ingredients vary in analysis to a slight extent. Sulphate of ammonia, for instance, varies from 20·6 to 21 per cent. minimum nitrogen content. Sulphate of potash varies from 48 to 50 per cent. minimum potash, and muriate of potash from 50 to 52 per cent.

Consequently, as it is not known from the label what are the exact percentages of the active constituent present in the original ingredients as used by the manufacturer, particulars calculated must be approximate only.

The second reason is that the Fertilizers Act requires a minimum guarantee to be stated on the label and allows no tolerance—with the consequence that the manufacturers use an over-run, that is, they put an excess of each ingredient into the mixture to ensure that the analysis guarantee is maintained.

Naturally, if a large discrepancy is ascertained, one would suspect the presence of filler.

Analyses taken in compiling the table are:—

Sulphate of ammonia ..	20·6 per cent. nitrogen
Dried Blood	12·0 per cent. nitrogen
Bone	3.5 per cent. nitrogen and 23·5 per cent. phosphoric acid
Meatworks fertilizer ..	5·0 per cent. nitrogen and 16·0 per cent. phosphoric acid
Superphosphate	20·5 per cent. water-soluble phosphoric acid
Sulphate of Potash ..	48·0 per cent. potash
Chloride (Muriate) of Potash	50·0 per cent. potash

To compound a mixed fertilizer to obtain desired percentages of nitrogen, phosphoric acid or potash, it must always be remembered that the quantities of ingredients used *must total* 1 *ton or* 100 *per cent.* Smaller quantities than 1 ton can, of course. be made up, but the ingredients must still be calculated from the table on the ton basis, and the amounts reduced in proportion.

The following table enables conversions to be made from parts per hundred to cwts. and lbs. per ton (i.e. per cent. to weight).

Conversion Table on the Basis of One Ton.

Per Cent.	Cwt.	Lb.	Per Cent.	Cwt.	Lb.
¼		6	11½	2	33
½		11	12	2	44
1		22	12½	2	56
1½		33	13	2	67
2		44	13½	2	78
2½		56	14	2	89
3		67	14½	2	101
3½		78	15	3	0
4		89	16	3	22
4½		101	17	3	44
5	1	0	18	3	67
5½	1	11	19	3	89
6	1	22	20	4	0
6½	1	33	21	4	22
7	1	44	22	4	44
7½	1	56	23	4	67
8	1	67	24	4	89
8½	1	78	25	5	0
9	1	89	26	5	22
9½	1	101	27	5	44
10	2	0	28	5	67
10½	2	11	29	5	89
11	2	22	30	6	0

Examples: 6 per cent. = 1 cwt. 22 lb. per ton, or 2 cwt. 33 lb. per ton = 11½ per cent.

Above calculations are made to the nearest lb.

How to Use the Table—

To obtain, say, 2 per cent. of nitrogen in a ton of final mixed fertilizer, 1 cwt. 107 lb. of sulphate of ammonia or 11 cwt. 48 lb. of bone may be used.

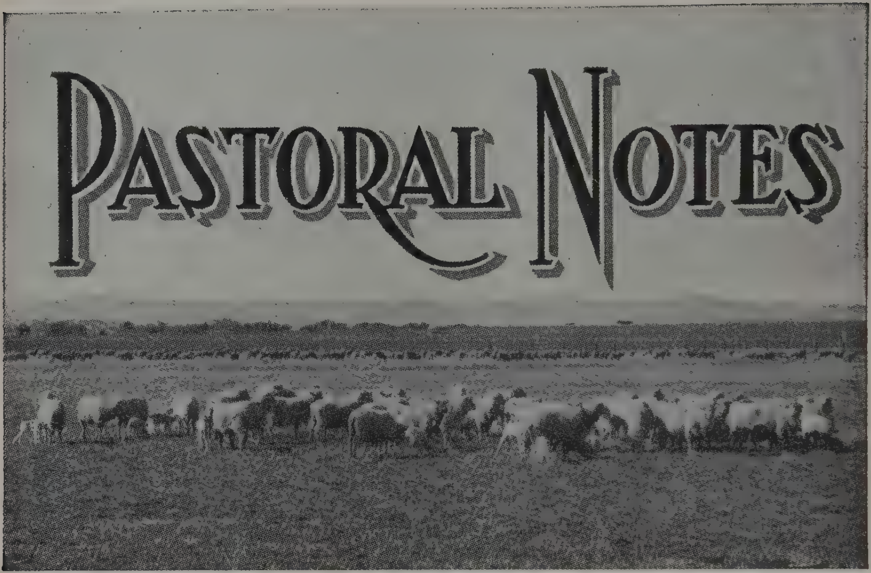
To obtain a complete fertilizer, containing 5 per cent. Nitrogen, 12 per cent. phosphoric acid, and 8 per cent. potash, by consulting the table:—

4 cwt. 98 lb. sulphate of ammonia;
11 cwt. 79 lb. superphosphate; and
3 cwt. 37 lb. sulphate of potash—

totalling approximately one ton, or other suitable ingredients, amounting to a ton may be used.

In the case quoted it will be noted that the amounts given total 19 cwt. 102 lb., which is 10 lb. under the ton. It is, of course, too much to expect that a grade formula consisting of round figures will give quantities that exactly total a ton. The separate amounts of ingredients should therefore be "rounded off"—in this case by adding, say, 3 lb. each to the sulphate of ammonia and sulphate of potash, and 4 lb. to the superphosphate.

In conclusion, it might be well to point out that only a certain number of grade formulae will be found to total anywhere near the ton with the ingredients available; obviously, a 2-10-2 would amount to only a portion of the ton while a 10-10-10 would amount to far more than the ton; consequently, neither of these grade formulae—or other "extreme" formulae—can be found on the market in Queensland.



Drenching Sheep.

ABOUT this time of the year worms are usually very troublesome in sheep. Before drenching, an effort should always be made to ascertain which species of worm is the cause of the trouble, and this can readily be done by a post-mortem examination of a badly infested animal. The fourth stomach, small and large intestines, should be cut open and examined carefully, and if the animals are coughing, attention also should be given to the lungs.

For the worm that occurs in the fourth stomach—the barber's pole worm—bluestone is recommended. Carbon tetrachloride is also very effective against this worm, but there is some risk attached to its use, and it is therefore no longer recommended by the Department of Agriculture and Stock.

Bluestone and nicotine sulphate are used for the removal of the small hair worms, which inhabit the small intestine. Hair worms are the cause of a disease known as "black scours." Infestation is most severe among young sheep, in which the losses may be very heavy. Bluestone and nicotine sulphate is the only drench which is of any value against these small worms.

Where a mixed infestation of stomach worms and hair worms occurs —a frequent experience, especially in young sheep—the bluestone-nicotine sulphate drench should be given, as this drench is effective against the stomach worm also. Moreover, it may be used for the removal of tapeworms from lambs, although these worms may also be removed by arsenic and epsom salts.

For the nodule worms in the large intestine, there is as yet no efficient method of removing them by means of drenches which are given through the mouth. They may, however, be combated by the use of an enema containing sodium arsenite, which, if administered carefully, has a very high degree of efficiency.

Lung worms are treated with certain drugs which are injected into the windpipe, the formula being—

Oil of turpentine—1 cubic centimetre.
Creosote—0·5 cubic centimetre.
Olive oil—2 cubic centimetres.
Chloroform—0·5 cubic centimetre.

This formula represents a dose for one adult sheep. For lambs, the dose is reduced by one-half.

In country subject to worms, the sheep should be given treatment at regular three to four weekly intervals during the summer months, for otherwise little or no benefit from the treatment may be evident. Treatment is to be regarded only as a temporary measure in the fight against worms, for it must be realised that when paddocks are heavily infested with worm larvæ the animal is no sooner freed of worms by treatment than it is attacked again by larvæ which are picked up by the animal when grazing. In about three to four weeks' time the larvæ have grown and have reached such a size and attained such numbers that the health of the animal is again affected.

Further information on mixing and administration of these drenches may be obtained from the Animal Health Station, Yeerongpilly.

CARE OF SICK ANIMALS.

Stock owners are frequently required to diagnose and treat sick animals and, from their constant observation of stock in good health, are quick to notice any abnormal behaviour due to sickness. A knowledge of the normal temperatures, pulse, and respiration rates of various animals is most valuable in arriving at a correct diagnosis of the trouble. The temperature of all young animals is somewhat higher than that of older animals, and various influences—such as periods of oestrum (heat), time of day, external temperature and so on—may alter the temperature of the mature animal. The temperatures of healthy farm animals are—horse, 99·5-101 degrees; cow, 100-101 degrees; sheep, 103 degrees; pig, 102·5 degrees.

The temperature of an animal is usually measured in the rectum, and a self-registering thermometer, such as is commonly used in ordinary medical or nursing practice, may be used. Care should be taken to see that the column of mercury is shaken down. A small quantity of vaseline smeared on the bulb as a lubricant to assist the passage of the instrument is desirable, and it is inserted with a circular motion between the fingers, forward in a line with the backbone, and allowed to remain for a few minutes before it is withdrawn carefully and the reading taken. If the temperature of an animal is found to be about 2·5 degrees above normal it is said to have a low fever, if it reaches the vicinity of 4 degrees above normal a moderate fever is indicated, and if in the neighbourhood of 6 degrees above normal it has a high fever.

In some diseases, such as tetanus and sunstroke, the temperature may be as much as 10 degrees above normal. Having decided by use of the thermometer whether the sickness is of a febrile (pertaining to fever) or non-febrile nature, treatment and nursing must be considered.

Good nursing is of the utmost importance. The patient should be provided with a soft bed, shade from sun, wind, or rain, and a rug in cold weather. A supply of water and green feed also should be provided if possible.

Medicines are usually administered by the mouth in the form of a drench, and it is necessary to use care and patience when using this method. The head of the animal should not be raised above a horizontal position, and only small quantities of the drench poured into the mouth at a time, allowing time for swallowing. Pinching the throat to induce swallowing should not be practised, and the head should be lowered if the patient commences to cough.

IMPROVEMENTS ON THE SMALL SHEEP PROPERTY.

When money is available a small grazing selection frequently carries improvements fit for a much larger property. On the other hand, when money is scarce, the small holding often lacks even the bare improvements essential to the well-being of the sheep and the handling of the clip.

A property has a certain capital value, and unnecessary improvements merely mean over-capitalization. Interest has either to be paid or allowed for this excess expenditure.

However, certain improvements are essential in all cases.

A substantial boundary fence is essential, and, should the district be dingo-infested, netting and top netting are also necessary.

Next in importance is the water supply. Should there be adequate natural water the selector is fortunate. Failing natural water, wells, sub-artesian bores, surface tanks, or bore drains to conduct supplies from neighbouring bores must be provided. The type of watering facilities to be used is essentially a matter of economics. What pays best, particularly in drought emergencies, should be a guiding principle in the grazier's choice.

A horse paddock and yards for the handy working of house cows are among the first provisions to be made. This paddock should be handily situated to the homestead and should contain water.

Subdividing of the property for the convenient working of sheep is seldom given sufficient thought. It involves not only the running of fence lines, but their construction in such a way that water is easily and continuously available to the stock. The fences should be substantially erected to obviate continuous drafting and boxing. Too much money may be spent in wrongly thought-out divisions, but, generally, the smaller the paddocks the better. The posts used for fencing should be of timbers proved in the district for their durability.

The shearing shed and drafting yards may, on a small holding, be close together. The shed should be well constructed and properly designed, but not larger than necessary for the competent handling of the numbers of sheep ordinarily run on the property. The yards also should be constructed substantially, and their correct design for the drafting of sheep is of first importance. Where shed and yards are together, the latter should be so placed that the shed can be conveniently filled with woolly sheep.

The situation of the homestead should permit the easy working of the property, and its cost should be no greater than the improved value of the holding warrants.

DIPPING SHEEP.

Dipping is the only successful method of freeing the flock from lice and ked. For dipping, a recognized proprietary material should be chosen and the directions for mixing followed implicitly.

Ordinarily, dipping should be done within a month after shearing, but not before all cuts or wounds have healed. A fine day should be chosen for the job. Extremes of heat or cold should be avoided.

Sheep should never be dipped when in a heated state. Yard them, if possible, the night before.

Immerse the sheep completely. Allow them to drain, and, if possible, dry in the shade. Avoid driving them long distances to paddocks after dipping.

Dipping pays, and, in addition, gives some protection against the blowfly.

CRUTCHING AND JETTING.

There is often controversy as to whether crutching or jetting is the better method of combating blowfly attack. There should be no argument on this score, for, with the increasing severity of fly invasion, both methods have their place in the protection of the flock.

There is a school of thought which insists that the wool should be left on the crutch of the sheep and jetting alone resorted to. Other graziers pin their faith to crutching and will not consider jetting.

It is thought that, singly, either of these methods may be unsatisfactory to some extent, inasmuch as both methods should be used in conjunction. To get the greatest immunity from fly strike, the grazier is advised to carefully crutch when—or before if practicable—the first fly invasion is likely to occur. This should give the flocks immunity for about two months. Should further treatment then be necessary, jetting the previously crutched sheep is advised. Thus with the intelligent combination of the two methods, reasonable protection should be assured.

BRUISING OF CATTLE.

The meat export industry is seriously prejudiced by the bruising of cattle when travelling to the meatworks, and the annual loss to both the owner and the State is considerable. Bruising is caused by many factors, particularly so when journeys are long, but the two chief causes are ill-treatment and horning, because of faulty supervision during trucking and in transit.

Cattle travelled to market on the hoof always give a higher percentage of first-class beef than railed stock, provided, of course, they have the condition and weights essential for export. Much of the bruising attributed to train travelling is caused in the trucking yards. In many instances, every endeavour is made to load the trains in a minimum of time. This is a mistake. Care should be taken to avoid crowding in gateways, because, where jamming occurs, the outer beasts are bruised on ribs and hips. Precautions are necessary both at the crush entrance and in the crush. If cattle are trucked in "single file," their sides do not come in contact with the rails. Drovers in charge should insist that no unnecessary force is used to drive the cattle, for every injury affects the quality of the carcase.

Competition in the chilled and frozen meat trade to-day is keen, each competing country endeavouring to produce a better carcase. Therefore, if Australia is to retain or increase her output of first-grade beef, the cattle received at the meatworks must be of prime quality and free from injuries of any kind. Growers and dealers may assist the trade by judicious handling of stock. Dehorning is essential. This is a simple operation and should be done when branding. Records proved conclusively that polled cattle give a much higher percentage of first-quality beef than horned cattle.

Dehorned cattle are also much more docile in the paddocks, cover less country when feeding, and retain condition longer.

LAMB-MARKING.

Lamb-marking should be done under the most hygienic conditions possible. The work consists of castration and the insertion of the registered earmark on the off ear of ram lambs, and of marking similarly the near ear of ewe lambs. In addition, an age mark is frequently placed on the ear opposite the registered mark. Tails are removed from all lambs.

The ewes and lambs should be mustered and yarded the night before marking, thus avoiding operating when the lambs are in a heated condition, which leads to excessive bleeding.

All instruments should be cleaned and disinfected thoroughly. Ear-marking pliers should be frequently dipped in a prepared disinfectant in the course of operations.

There are two recognised methods of castration—viz., slitting and tipping.

Slitting has its advantages in that it leaves the wether with a more pronounced cod. However, when flies are bad there is a greater tendency for the lamb to become fly-blown. In tipping, the tip of the purse is entirely removed. Tipping is the better method of the two in the opinion of many sheepmen, as it leaves a cleaner wound with better drainage. The wound so made also heals more satisfactorily. Moreover, tipping is faster—a fact which counts when thousands of lambs have to be marked.

The best age at which to mark is from a fortnight to three weeks. A proved fly remedy, both curative and antiseptic, should be applied to all wounds. The use of old yards should be avoided if practicable.

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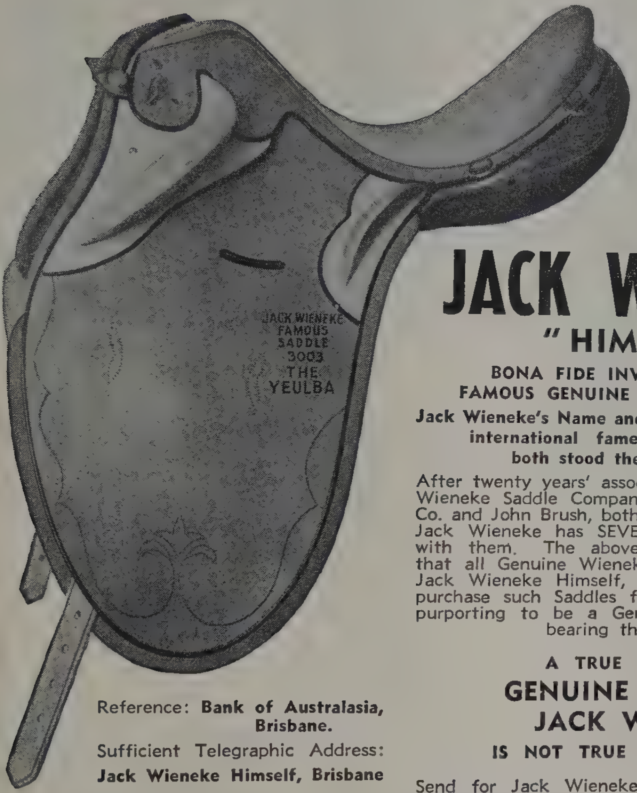

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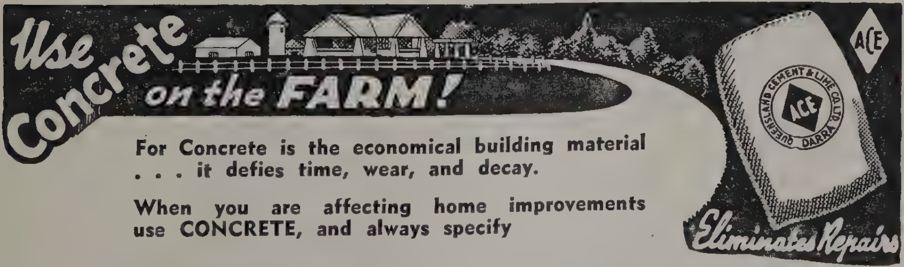
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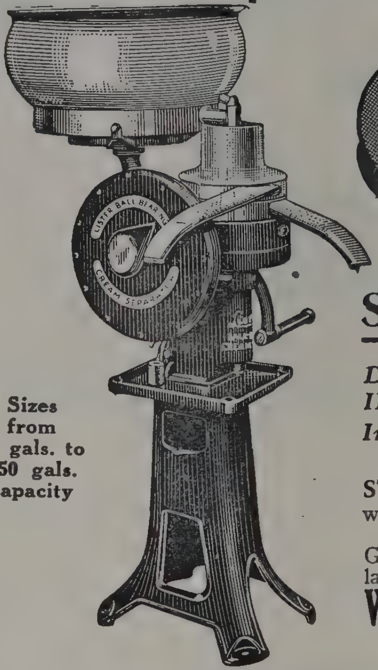

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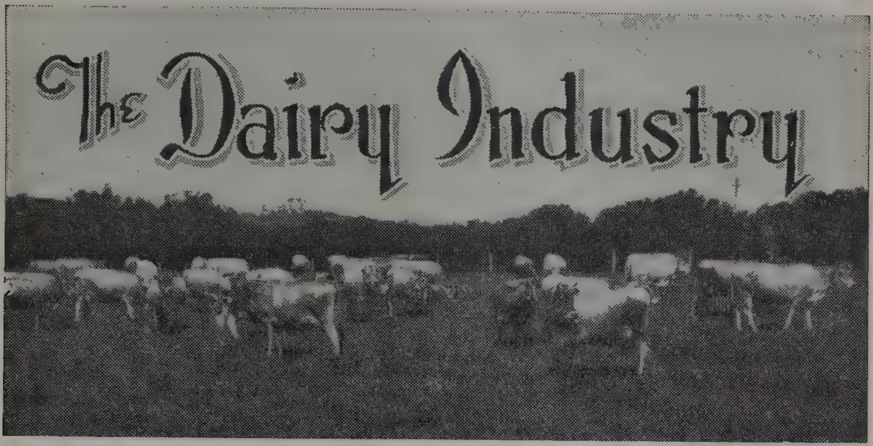

Herd Testing and Recording.

THE object of herd-testing is to enable the farmers to estimate the worth of each cow in his dairy herd. The importance of this estimation is obvious. Not only does the farmer discover his best producers, from which to breed, but he also discovers the low producers—the animals which are definitely a liability, and which should be profitably removed from the herd.

Although it is necessary for a dairy farm to have the services of a good bull from a reliable milking strain, and also to practise the best known methods of handling and feeding stock in order to reach as high a production of milk as possible, it will be found that no appreciable standard will be achieved unless these methods are combined with systematic herd-testing and recording. From the knowledge so gained, low-producing animals may be gradually culled.

Queensland is one of the few countries in the world where herd-testing and recording is done absolutely free of cost to the farmers. Notwithstanding this it is remarkable that the response is so small. The fact is that a mere few hundred dairy farmers are availing themselves of this opportunity of improving their herds.

Probably some people have the idea that "something for nothing is not worth having." However, it is the sincere aim of the Department of Agriculture and Stock to assist farmers as much as possible, with a minimum of expense.

When farmers adopt the method of herd-testing advocated by the Department, an "application and agreement" form is sent to the farmer, asking him to sign it and return it to the Department of Agriculture and Stock. This form states that the farmer must be willing to submit his herd for testing five times at intervals of approximately fifty-five days. The lactation period of a cow is regarded as 273 days for the purpose of this testing scheme, and, therefore, it is necessary to test five times, with the required intervals between, if reasonable accuracy is to be attained in the estimation of the production of each cow.

When the "application and agreement" form is returned by the farmer after its completion, a case of composite sample bottles, each containing a few drops of preservative, together with a chart and measuring ladles, is sent to the farmer, with a request for him to take samples and return the case on a given date. One sample bottle is allowed for each animal. When commencing testing, it is not desirable to include cows which are more than 60 days in milk.

It is necessary for the farmer to weigh the quantity of milk produced by each cow over a 48-hour period, and to take a sample of milk from each cow at each milking during that period, using the large ladle for measuring the morning's milking and the smaller one for the evening's milking. The farmer must place each cow's name on the form supplied, and also the weights of milk and the dates of calving. The numbers on the composite sample bottles must correspond with those on the form opposite each cow's name.

When the sampling is completed, the farmer returns the box of samples, together with the chart showing particulars of cows' names and weights of milk, to the Department. This chart is returned to the farmer on completion of testing and recording by the officers of the Department. The cost of railage both ways on the case of samples is borne by the Department of Agriculture and Stock.

Estimating the Value of Each Cow.

Many people imagine that a cow producing a certain quantity of milk is worth more than a cow producing a smaller amount of milk. This would probably be so in the case of a farmer supplying milk for immediate domestic consumption, but it may not be so where cream produced from this milk is supplied to a butter factory.

The percentage of butter-fat varies considerably in milk from different cows. Therefore, the milk from the cow producing the smaller quantity may be much richer in butter-fat than that from the high milk-producing animal. This probably would result in the smaller milk-producing animal being regarded as the more valuable.

When the samples of milk are received from the farmer, they are tested by qualified testers, using the Babcock test. The object of this test is to ascertain the percentage of butter-fat in each cow's milk. When this is determined, it is multiplied by the quantity of milk produced during the preceding twenty-four hours and divided by 100, and this gives the quantity of butter-fat produced during twenty-four hours. This figure is again multiplied by the number of days between the date of calving and the date of the first test. The figure then obtained is the quantity of butter-fat produced during the first testing period. This procedure is followed for each of the five tests, and at the end of the 273-days period the quantity of butter-fat estimated for each test is added together, thus giving the quantity of butter-fat produced by each cow during the whole lactation period. The price of butter-fat is roughly calculated as 1s. a lb.; therefore, the value of each cow over the 273-days period is estimated by multiplying the number of pounds of butter-fat produced, by 1s.

Example.—A cow calved on 1st January and was tested on the following dates:—25th February, 21st April, 15th June, 9th August, and 1st October.

The weights of milk for 24 hours, together with percentages of butter-fat, were:—

14th February—25 lb. milk containing 3 per cent. butter-fat;
10th April—26 lb. milk containing 4 per cent. butter-fat;
4th June—20 lb. milk containing 4 per cent. butter-fat;
29th July—18 lb. milk containing 5 per cent. butter-fat;
20th September—10 lb. milk containing 4·5 per cent. butter-fat.

The quantity of butter-fat produced in the first test = amount of milk for 24 hours multiplied by rate of test, divided by 100, and this result multiplied by 55 (number of days between date of calving and date of first test)

$$= \frac{25 \times 3}{100} \times 55$$

= 41·25 lb. butter-fat.

Similarly, the quantity of butter-fat for the second test = 57·2 lb. butter-fat.

The quantity of butter-fat for third test = 44 lb.

The quantity of butter-fat for fourth test = 49·5 lb.

The quantity of butter-fat for fifth test = 23·85 lb.

Therefore, the total quantity of butter-fat produced during the 273 days = 4·25 + 57·2 + 44 + 49·5 + 23·85

= 215·8 lb.

= 216 lb. (nearest lb.).

Butter-fat is estimated at 1s. a lb.

Therefore, the cow produces 216 lb. butter-fat, which at 1s. per lb. = £10 16s. during 273-days lactation period.

It should be remembered that all the recording work mentioned is computed by the herd-testing staff, and at the end of the lactation period a final return-sheet is sent to the farmer, showing the quantity of milk and butter-fat produced by each cow in his herd over the 273-days period.

The farmer should not be content merely to find out what each cow in his herd is worth. He should take immediate action, if practicable, to remove the lowest-producing females from his herd, and concentrate on breeding from animals yielding the highest returns.

Inquiries about herd-testing should be addressed to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane.

INFERIOR CREAM.

One of the most common sources of the contamination of cream, and one that is often overlooked, is the badly washed cream can.

More cream is spoilt by being stored or carried in a badly washed can than by most other ways. This applies to cans in good order as well as those that are dinted and rusty.

The reason is not far to seek. Hundreds of cans pass through the same rinsing water of the mechanical can-washer at the butter factory daily, and although a final steaming is carried out in the last stage of the washing process, it is not of sufficient duration (nor is it practicable) to sterilize thoroughly all of the cans thus treated.

It should be obvious that cans which have contained second-grade cream will require extra attention, in order to prevent the transmission of taints due to bacterial activity—such as cheesiness and rancidity—to the fresh supplies of cream.

A tallowy smell which is often found in returned cans may be due to inefficient washing, followed by exposure to the heat of the sun, causing deterioration of the fat.

It is, therefore, advisable, in order to safeguard the quality of cream, to rinse all cans on their return from the butter factory with boiling hot water to which a little washing soda has been added. The cans should then be rinsed with clean boiling water to remove all traces of the soda.

The storage of the cleansed cans is important. They should be placed upside down on a suitable rack to allow for cooling and drying. On no account should anything but boiling water be used for the final rinsing, nor should any attempt be made to dry the cans with a cloth. The storage rack should be placed in such a position as to be well removed from any possibility of contamination from the stockyard.

◆

CREAM-STIRRING.

Some dairy farmers show by the cream which they send to a factory that they lack knowledge in regard to the care of cream on the farm. Clean methods in production may be nullified by the spoiling of good cream in the dairy.

As butterfat is the lightest constituent of cream it rises gradually to the top as soon as the cream enters the can. Therefore, in unstirred cream the lower layers, rich in separated milk—which contains a high proportion of casein, and consequently a low proportion of butterfat—are at the bottom. Changes in the separated milk due to bacteria are often such that when the cream reaches the factory it is graded down as sour and curdy.

A dry film on the top of the cream or layers of different colours and texture through the can tells the grader at once that the cream has not been stirred, and he is immediately impressed by the defects in it.

To keep a uniform consistency of cream and to ensure the best possible ripening conditions the cream should be cool before it is added to any existing supply. Regular stirring is then necessary to liberate accumulated gases and aerate the mass, which ensure uniform consistency. Aeration not only reduces the temperature of the cream, but also retards the growth of undesirable bacteria.

Stirring pays because no dairy farmer can afford to lose the difference in price between choice and lower grade creams on each consignment that he sends to the factory.

The PIG FARM

Live and Dressed Weight of Bacon Pigs.

THE loss of weight in transit of a pig from farm to factory and through the process of slaughter, dressing, and cooling varies with pigs at different weights. Generally lighter weight, unfinished pigs shrink more than heavier weight, prime conditioned stock.

Factors which affect the amount of loss are the size and weight of the pig; the way in which the pig has been fed and ''finished''; the weather; distance from farm to factory; conformation and condition of the pig; the amount of food eaten before the pig is weighed alive. There also are variations in animal individuality; for instance, some pigs are of a nervous, excitable disposition, and fret, while others are more contented and are not affected by the journey.

In extensive tests it has been shown that, under conditions similar to those ordinarily ruling in Queensland, pigs weighing 150 lb. to 200 lb. alive on the farm lose about 10 per cent. of this weight in actual transit to the factory, and then another 20 per cent. in dressing and cooling off. Lighter pigs, weighing 100 lb. to 140 lb. alive on the farm, usually lose approximately 33 per cent. by the time they are dressed and cooled off. While these figures are possibly a fair average, individual pigs varied considerably.

On the sale of about 1,000 bacon pigs from experiments conducted conjointly by the Departments of Agriculture and Stock and Public Instruction in Queensland, results were as follows:—

All pigs were weighed after a twelve-hour fast at the sty. They also were weighed at the factory before slaughter not more than twenty-four hours afterwards and were weighed again in the usual way at the factory after slaughter. The average loss from live weight on the farm to actual cold dressed weight at the factory was 30·5 per cent., varying from 25 per cent. to 34 per cent., with heavier losses on lighter weight stock marketed slightly unfinished for purpose of comparison.

These deductions may be accepted as a guide to the general average of factory deductions in Queensland.

ISOLATION PEN FOR SICK PIGS.

The distance betwen isolation pens for sick pigs and the pig yards or dairy structures is not so important as the relationship of these structures from another point of view. Thus, while advising a minimum distance of, say, 150 feet, it should be emphasized that such isolation should be so placed that—

(*a*) No drainage from it can spread to the main sties or any of the dairy buildings; and

(*b*) That if healthy pigs are allowed to wander, the isolation pen should be so guarded that they cannot make contact with it.

Ordinarily, therefore, the isolation pen should be on lower ground, and, if in the paddock in which pigs wander, should be protected by fencing in such a way that healthy pigs cannot come in contact with it.

CARELESS BRANDING CONDEMNED.

Most pig raisers are now conscious of the necessity for branding pigs offered for sale. Where practicable, the body tattoo method of branding is now in fairly general use. However, there are cases where it is desired to identify live pigs on arrival at bacon factories or saleyards, and for this purpose body tattooing is not suitable; in the absence of a more satisfactory method of branding, the firebrand is used.

The firebranding system is open to abuse in the hands of a careless man, and pigs which have been injured through faulty branding are sometimes noticed at bacon factories and saleyards. Their carcases are so blemished as to lower their value to the trade. The most common mistakes in firebranding are the use of too large a brand, and its application for too long a period—thus causing a deep burn in the skin of the pig which becomes an ugly sore.

Pigs with blemishes caused through faulty branding are not required by the trade. It is frequently observed that exporting buyers at the Cannon Hill saleyards refuse to bid for badly branded pigs. This, of course, reduces competition, and the blemished pigs are sold at a comparatively low price.

Where pigs must be firebranded, a small brand should be used; the pigs should be clean and dry, and the brand used very hot and applied lightly and quickly on the shoulder or neck.

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Name and Address.	Name of Hatchery.	Breeds Kept.
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F. J. Akers, Eight Mile Plains	Elmsdale	White Leghorns and Australorps
E. J. Blake, Rosewood	Sunnyville	White Leghorns, Australorps, White Wyandottes and Rhode Island Reds
R. H. & W. J. Bowles, Glenmore Road, North Rockhampton	Glen	White Leghorns and Australorps
J. Cameron, Oxley Central	Cameron's	Australorps and White Leghorns
M. H. Campbell, Albany Creek, Aspley	Mahaca Poultry Farm and Hatchery	White Leghorns and Australorps
J. L. Carrick & Son, Manly road, Tingalpa	Craigard	White Leghorns
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme	White Leghorns, Australorps, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros.	White Leghorns
Elks & Sudlow, Beerwah	Woodlands	Australorps and White Leghorns
W. H. Gibson, Manly road, Tingalpa	Gibson's	White Leghorns and Australorps
Gisler Bros., Wynnum	Gisler Bros.	White Leghorns
G. Grice, Loch Lomond	Kiama	White Leghorns
J. W. Grice, Loch Lomond	Quarrington	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. & C. E. Gustafson, Tannymorel	Bellevue	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby	Anconas and White Leghorns
J McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Australorps. and Brown Leghorns
A. Malvine, junr., The Gap, Ashgrove	Alva	White Leghorns and Australorps
H. L. Marshall, Kenmore	Stonehenge	White Leghorns and Australorps
W. J. Martin, Pullenvale	Pennington	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview	White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, Brown Leghorns, and White Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric Hatcheries	White Leghorns
J. W. Moule, Kureen	Kureen ..	White Leghorns and Australorps
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Silver Campines, and Light Sussex
S. V. Norup, Beaudesert Road, Cooper's Plains	Norup's ..	White Leghorns and Australorps
H. W. & C. E. E. Olsen, Marmor	Squaredeal Poultry Farm	White Leghorns, Australorps, Black Leghorns, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Rhode Island Reds, Light Sussex, White Wyandottes, Langshans, Khaki Campbell and Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Oxley Central	..	Australorps and White Leghorns
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Australorps, Langshans, Rhode Island Reds, and Brown Leghorns
G. R. Rawson, Mains Road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View Poultry Farm	White Leghorns and Australorps
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, The Gap, Ashgrove	Smith's ..	White Leghorns and Australorps
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkin's Poultry Farm	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Herberton road, Atherton	Weaver's Stud Poultry Farm	Wyandottes, Indian Game, Barred Rocks, Australorps, White Leghorns, Anconas, Rhode Island Reds, Buff Orpingtons, Black Orpingtons, and Buff Leghorns.
H. M. Witty, Kuraby	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	Brown Leghorns, White Leghorns and Australorps
R. H. Young, Box 18, P.O., Babinda	Reg. Young's ..	White Leghorns, Brown Leghorns and Australorps

Following is a list of new applications received up to the 24th January, 1940:—

J. E. Caspaney, Kalamia Estate, Ayr	Elvington ..	White Leghorns
T. Duval, Home Hill	Duval's.. ..	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
H. Hufschmid, Ellison Road, Geebung	Meadowbank Poultry Farm	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
C. Mengel, New Lindum road, Wynnum West	Mengel's ..	Australorps
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
V. White, Cleveland	Pinklands ..	White Leghorns ..

WORMS IN POULTRY.

Many young birds will soon be commencing their first season of production. During the rearing of these birds diseases such as coccidiosis, pullorum disease, and roup will have taken their toll. These diseases are spectacular in their onset and the symptoms manifested and the mortalities experienced have compelled the poultry farmer to undertake control measures in order to minimize his losses as much as possible.

In many instances, however, worm infestation has been overlooked. The effects of worm infestation are usually insidious in nature, and being accumulative do not attract attention until the birds are seriously affected. Such effects include failure to make normal growth and even loss of weight, loss of appetite and activity, dull, ruffled plumage, and a paleness of the comb and shanks. The mortality, especially among young birds, may be serious. More important still, young pullets, while maintaining a ravenous appetite and being apparently in fair health, may not be producing their normal quota of eggs.

Of the various worms which infest poultry one of the most important is the large roundworm, which grows up to 4 or 5 inches in length, and is found in the intestine. Where the farmer pays careful attention to sanitation and cleanliness this and other worms rarely become dangerous. By the regular removal of droppings and the adoption of other measures which promote cleanliness, the source of infestation is removed. Prevention of infestation is most important in the control of parasitic worms. There are, however, certain drugs which may be employed to remove the worms from the birds, and if treatment is employed regularly the infestation should be of no great importance. Treatment of poultry for worms may be undertaken either by mixing certain drugs with the mash (flock treatment), or else by giving the drug to each individual bird (individual treatment).

Flock Treatment.—Flock treatment can be applied with success only when the birds are kept under intensive or semi-intensive conditions. The procedure is to mix nicotine sulphate with the mash at the rate of ·5 cubic centimetre of nicotine sulphate for every 1 lb. of dry mash. The amount of nicotine sulphate required is incorporated with just sufficient water so that when mixed the mash is flaky. About 1 part of nicotine sulphate to 400 parts of water is usually adequate. The mixing should be thorough so that no lumps remain. This treated mash is mixed fresh daily and fed continuously for four days.

Individual Treatment.—The best drug to use for individual treatment is carbon tetrachloride. This may be given in capsules or by means of a syringe and rubber tubing. The birds are starved overnight and treated next morning. They may be fed immediately after treatment. The doses range from ·5 cubic centimetres to 2 cubic centimetres, depending on the size of the bird. If the syringe is used great care must be taken to avoid delivering the drug into the windpipe, which would cause instant death. Before undertaking this treatment, farmers should apply to the Animal Health Station, Yeerongpilly, for further details.

Agricultural Notes

Seed Maize Selection.

As like tends to beget like, the necessity of selecting seed from ears of desired type and known parentage is obvious. Some farmers, however, do not realize the importance of this, and are satisfied to sow seed of any breeding, provided the grain is sound and germinates readily. Uniform tasselling and maturity cannot be expected from such seed. When times of tasselling do not coincide, there is poor fertilization of late-maturing plants and reduced yields follow.

The general improvement of a crop and the rapid elimination of undesirable characters can only be brought about by a regular process of seed selection. Isolation of the growing crop is necessary to ensure that cross-fertilization with maize in neighbouring fields does not occur. That is all the more important because wind and insects frequently carry pollen over long distances. Where isolation is not possible, sowings may be arranged so that tasselling times do not coincide.

It has been proved beyond doubt that locally-grown seed is more suitable for planting that comparable supplies of the same variety secured from outside sources. Farmers should, therefore, endeavour to improve their own seed by rigorous selection from year to year—provided, of course, the variety grown is continuing to give satisfaction—rather than buy seed annually, which cannot always be guaranteed as to its type and purity.

Seed selection may be carried out by the grower both on the field and in the barn.

Field selection is the better way, and it can be done conveniently when the corn is being pulled. More essential characters can be taken into consideration during field selection than are possible in the barn, where characters in the cob are alone considered. In the most rigid field selection the characteristics of only one parent can be determined, but even so seed selected from plants showing the following characteristics should give the best possible crop in the coming season:—

(1) The crop should have matured naturally, be thoroughly dry, and free from disease.

(2) Ears, when compared with the stalk, should be comparatively large and selected from those plants remaining upright.

(3) One good single ear to a plant is better than two mediocre ones, but where possible select from a plant with two good ears.

(4) Position of the ear on the stalk is important, for if too high from the ground harvesting is difficult, and the risk of lodging is greater. If too low there is a danger of loss through weed overgrowth and also slow drying out in showery weather.

(5) Most varieties sucker to a greater or lesser extent, but the smaller the sucker development the better the plant.

(6) The ears should be firmly attached to the stalk and droop when ripe. The point of the cob should be well covered by the husk as a protection against insects and the weather.

(7) The cob itself should be of moderate size, both in length and thickness, cylindrical (not tapered) in shape, having a well-filled butt and tip, yielding when threshed a high percentage of grain. Such cobs are much heavier than the average.

(8) The grain itself should be typical of the variety, uniform in depth and shape, and tight on the cob in regular straight rows.

Of all the characteristics in the grain, the farmer can least afford to overlook mixed colour, for maize showing this defect sells at a disadvantage if the crop is sold in the open market.

THE TRENCH SILO.

Large quantities of suitable fodders—comprising maize, sorghums, panicum, lucerne, and useful native grass and herbage mixtures on cleared pasture areas—are growing at present in many districts. That interest is being taken by more farmers in the conservation of the season's abundance is shown by the number of pit silos being constructed for the storage of the summer fodder surplus. There also is, however, some evidence of apparent apathy in respect of the establishment of fodder reserves. As much of this material has now reached the prime stage, the best way to conserve it would be to place it in a trench silo, and the attention of dairy farmers is directed towards this cheap and effective method of storage.

A few important points in the construction, method of filling, and emptying of the trench are briefly given for the benefit of interested farmers.

Select a reasonably level and well-drained site as near the place of feeding as conveniently possible. Mark it out according to the capacity required. A trench 30 feet in length, 8 feet wide at bottom, 12 feet at top, and 8 feet deep, having an outslope at each end of 1 in 3 grade, would hold approximately 45 tons. By altering the length and retaining the other measurements, the capacity may be increased a ton for each additional foot length.

To construct the trench, excavate according to the desired dimensions, using plough and scoop and depositing the spoil along either side to back up the logs, which should be placed lengthwise to raise the walls 2 feet above the surface. Complete the job by trimming the walls smooth with mattock and spade.

The cost of construction involves labour only, and the time taken would vary according to the nature of the ground. In ordinary circumstances, two men equipped with suitable plant should excavate a trench of 45-ton capacity in about two or three days.

In filling the trench silo there is no necessity to chaff the material, full-length crops being loaded in the field and drawn through the trench, off tipped, and spread in even layers lengthwise, the empty vehicle passing out the other end. Thus each layer is consolidated as a result of the trampling of the horses' action throughout the whole filling process.

Should the crop be at all dry through over-maturity or as a result of frost, a sprinkling of water may be added during the filling process. The filling should continue well above the surface, forming a parapet of about 3 feet high, sloped towards the sides of the trench.

Complete the filling by covering it with grass well watered, finally topping with a 9-inch to a 12-inch layer of earth.

The material so stored will be fit to use as silage in from two to three months after filling, if so desired, or it may be safely stored for many years without undue deterioration or loss.

To remove the silage for use, the trench should be opened up at one end, taking the earth and grass covering from a portion only as required, and cutting down vertically with a sharp inplement, such as a spade or hay knife. When a complete face section from top to bottom has been removed, an adze may be used to slice off additional material in a semi-chaffed or short-chopped form, resulting in its being in a more acceptable condition for feeding direct to stock without further preparation.

The silage may be fed as it is to practically all classes of stock. For cows in full milk, however, better results are obtained by the addition of a small quantity of protein-rich fodder and concentrate—such as lucerne chaff and cotton-seed meal.

Further particulars about silos and silage may be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

ESTABLISHING LUCERNE.

Lucerne is grown for hay purposes chiefly in warm districts on deep calcareous soils provided with abundant moisture. In such situations heavy crops are produced over a number of years. Within recent years the cultivation of lucerne has been extended into fairly dry districts, but most success may be expected on soils rich in lime and with ample moisture available to the plants.

Land intended for lucerne is best cropped with a cereal—such as wheat, oats, barley, or rye—or panicums and millets—prior to its preparation for lucerne. Stubbles should be cultivated to induce volunteer growths of weeds and other seeds; these should be turned in subsequently by ploughing. For a first cultivation, two deep ploughings should be given at right angles to each other. Moisture should be conserved by frequent cultivation. In dry districts, where a good rainfall cannot always be depended upon at seeding time, fallowing is particularly necessary for the purpose of conserving moisture. The land may therefore be ploughed in late autumn or early winter the year before it is intended to sow. The depth of the ploughing is governed by the character of the soil. Alluvial soils should be ploughed to a depth of about 7 inches, but on other classes of soil of lighter or more porous nature a depth of 4 to 5 inches is sufficient. The ploughed land should then be allowed to lie in the rough state for a month or so and be broken down with harrows after summer rains. During summer the land should be frequently worked with harrows or cultivators, so as to allow neither growth of weeds nor the formation of a hard crust on top. If the seed-bed cannot be worked down sufficiently fine with the harrows, a one-way disc cultivator or roller will do all that is necessary. If the land is rolled, it should be harrowed immediately after the rolling. Where the soil surface shows a tendency to dry out just prior to sowing, a light ploughing may be given and followed by the harrows. Sowing on top of the harrowed surface, followed either by a light rolling, or by brush harrowing, is a good practice—but if rolling is adopted, a set of light harrows should be used immediately afterwards. Rolling assists in bringing the soil particles in closer contact with the seed and works in the same manner as compressing a partly dried-out sponge.

Lucerne is best sown in April or May, the young plants then being sufficiently well established before the onset of cold weather to enable them to survive. Provided the seed is drilled in, a sowing rate of 12 to 14 lb. per acre is ample, and often too much, in the best lucerne-growing districts. If hand broadcasting is practised, slightly more seed should be used. The rate of seeding should be lighter in dry districts, and for grazing purposes, a seeding of as low as 2 lb. per acre is permissible. Seed sown on the surface should be covered by means of a light harrowing.

Though fertilizers are not used to any considerable extent in the main lucerne-growing areas, many growers have obtained payable results by applying up to 1½ cwt. of superphosphate per acre, either drilled in with the seed or used as a top-dressing. Nitrogeneous fertilizers appear unnecessary.

Fully a month or six weeks will pass before the young root system becomes established and the lucerne is fit for its preliminary cutting by the mower. An early mowing, before the young lucerne flowers, acts as a pruning and stimulates the root growth. After the preliminary cutting, a light harrowing may be made if absolutely necessary because of foreign growths.

Often promising stands of lucerne, following good germination, are destroyed through cutworm attacks. Damage at this time is irreparable, for the blank spaces are filled with weeds which considerably lessen the value of the crop. The Paris green-bran cutworm bait broadcast at the rate of 30 lb. per acre gives effective control, provided it is distributed as soon as the depredations of the pest become apparent. The necessary materials should therefore be held in stock on the farm for emergency. Cutworms attack only very young lucerne and intelligently applied baiting is then quite safe. Bait distribution in established crops is undesirable because of the possible risk of stock poisoning.

IMPORTANCE OF MOLASSES AS FERTILIZER.

Reference was made elsewhere in this Bulletin to the danger of a potash shortage with which Queensland is faced, should overseas supplies of this fertilizer not come forward regularly. In this event, the economic utilization of molasses as a fertilizer assumes a new significance. On current production, some 13,000,000 gallons of molasses are utilized annually in the cane areas, either as fuel, feed, or manure. Allowing an average potash content of 3 per cent. (equal to 6 per cent. muriate of potash), the ''available'' molasses is equivalent to almost 5,000 tons of muriate of potash, which is capable of supplying the annual requirements of the Queensland canegrowers.

Of course, the most economic utilization of this by-product cannot be made to enable the substitution to be complete. Much of the molasses is available in areas where the use of potash fertilizers is not absolutely essential: it is not possible to spread the material conveniently at a rate less than about 5 tons per acre, which supplies potash in excess of the needs of the crop immediately following; and the transportation of molasses more than a few miles from the mill quickly adds to its cost.

At the same time, it is well to recognize that this material does provide the means for overcoming what may be a substantial difficulty. Mills could assist in alleviating a shortage, should it arise, by carefully rationing such molasses (or ashes produced by the burning of the material), so as to confer the widest benefits on all suppliers. Canegrowers, in turn, could also help out by refraining from all potash purchases, in an emergency, for those fields which have just been given a top dressing of molasses. This piece of advice to the farmer is, of course, one which is made by the Bureau at all times. There is little virtue—and possibly much expenditure—in applying, say, 100 lb. of muriate of potash per acre, to land which has already been given the equivalent of 600 lb. in the form of a molasses application.

—H.W.K., in ''The Cane Growers' Quarterly Bulletin.''

THE PLOUGH.

The plough is still the most important implement in agriculture, in spite of all the engineering progress which has been made. Over and over again it has been claimed that our modern cultivators have reached the stage of development when they are considered capable of doing the whole work of preparing the soil without the use of the plough. But time has proved that the plough still remains indispensable. The rototiller, or some other implement, may one day push the plough on to the farm scrap heap, but that time has not come yet.

Most of the bad ploughing seen on a day's run through farming lands can be traced to the faulty setting of the plough. Apart from other points, the influence of ''set'' on the draught of the plough is very great. Another serious result of faulty setting is the wear and tear on the plough itself.

Again, disc ploughs with badly-worn discs are frequently seen in use. Provided the plough is otherwise mechanically sound, the obvious remedy for faulty ploughing in such cases is to fit a new disc.

After all, it is not a hard job to set a plough properly. There is no magic or mystery about it. No special skill is called for. All that is required is a fundamental knowledge of the purpose of each part of the implement, and the ability to use that knowledge, so as to make each part work in harmony with the whole, and thus preserve what is known as the "balance" of the plough. Any experienced ploughman will show the new hand how to set the implement, and there is nothing better than a sweetly running plough.

THE HORSE'S NOSEBAG.

The nosebag for working horses is more or less a necessary evil. Usually, it gets scant attention, and yet the owner of horses so fed often wonders why they go off their midday feed, and yet eat greedily at night. He is then inclined to make the midday feed too light and the night feed too heavy. The reason is plain. Food residues in the nosebag have soured, because of the presence of moisture and saliva.

The considerate horse owner will turn the nosebag inside out each day and expose it to sunlight. Further, he will always keep a spare nosebag to use when the other goes to the weekly wash in hot suds.

RHODES GRASS AS A HAY CROP.

While the value of Rhodes grass as pasture is well recognized in Queensland, its usefulness as a hay crop is little appreciated. Not only could fodder reserves be built up on the farm or station by conserving surplus Rhodes grass pasturage as hay, but, in some circumstances, sowing down of special areas to Rhodes grass for hay would be sound agricultural practice.

The cutting of hay from grassed country will be restricted, necessarily, to cleared land with a fairly even surface, and is practicable only in seasons of abundant growth. When seasonal conditions are such that a surplus of grass is indicated at an early date, the paddocks which can be mown should be closed to all stock and permitted to develop to the hay stage, when the crop may be harvested. In normal seasons, if the cutting is made during summer, the grass will recover quickly.

Apart from lucerne, the main summer-grown hay crops (e.g., Sudan grass and millets) are annuals. Cropping with annuals has the very obvious disadvantages of high cost of production and of exposing soils to erosive influences, particularly storm waters. A perennial or long-lived hay grass costs little to maintain, prevents erosion, improves the texture of the soil, and adds materially to its organic content. Although it is not suggested that Sudan grass and millets should be abandoned as hay crops in favour of Rhodes grass, farmers and pastoralists might well give consideration to the testing of Rhodes grass for hay purposes.

Because of its susceptibility to injury by heavy frosts, Rhodes grass is, however, not likely to prove more useful than a rotation of annuals in the colder regions of the State, such as parts of the Darling Downs.

In the drier localities in which Rhodes grass is grown largely, the hay is easily cured. In most cases it should be in the stack within forty-eight hours of cutting. The yield varies, of course, with seasonal and soil conditions, but on fertile soils young stands should provide at least two cuttings a year, each of 1½ to 2 tons of hay to the acre. The quality of the hay, particularly its palatability, is somewhat variable, but all classes of stock will eat it without much waste.

LUCERNE ON THE DOWNS AND MARANOA.

Although comparatively few settlers in the Western Darling Downs and Maranoa districts have established lucerne stands, it is significant that most of those who have done so plan a considerable increase in acreage. The qualities of lucerne as a grazing proposition, both for sheep and cattle, are gaining wider appreciation outside the recognized agricultural regions. The results obtained on scrub and forest lands during dry spells at Guluguba, Coolumboola, Wallumbilla, and other localities are very encouraging. An adaptation of lucerne to a wide range of soils and a capacity for giving good results under adverse climatic conditions were clearly demonstrated.

In sowing lucerne, high seeding rates are unnecessary and have been the cause of many failures in the past; 3 to 4 lb. per acre is quite heavy enough for the districts named.

With the wide variation in farming conditions and soil types that obtain in these districts, hard and fast rules regarding sowing are not practicable. The following points are, however, important:—Deeper sowing than ¾ inch is inadvisable in all soils, except those of a self-mulching nature where, if necessary, the depth may be a little greater—provided that there is sufficient moisture to give the plant a good start, in addition to germinating the seed.

Where old wheat land is to be converted into pasture, it is usual to sow the lucerne with the last crop of wheat. This method reduces costs to some extent; but, in soil that has a tendency to pack or cake after rain, it is advisable to drill the wheat in first and then follow with the lucerne—having the drill hoes out of the ground, and covering with light harrows. This avoids planting the lucerne at the same depth as the wheat—i.e., 2-2½ inches.

When broadcasting, it is difficult to get an even sowing with the small seed; but, if two sowings are made, one across the paddock and the other in the opposite direction, a more even crop can be obtained. Only light harrows should be used to cover the seed.

On small holdings where more intensive culture is practised, a method of sowing which might commend itself to dairymen, particularly in the Maranoa district, is to plant lucerne in rows 18 inches to 2 feet apart. Inter-row cultivation may then be practised when necessary after rain. Established in this way, the plant has exceptional drought resistance and an area of green feed for emergency use is assured.

All settlers in the reclaimed prickly-pear country might well turn their attention to lucerne as a grazing crop. With light seedlings it is not expensive to establish and is well worth a trial.

CLOVERS ON THE COAST.

A marked increase in milk production in late winter and spring when white clover is plentiful in the pastures is a common experience in coastal dairying districts. Unfortunately, it is not every year that weather conditions are favourable for the development of a good growth of clover in unimproved paspalum pastures.

Generally, the requirements of clovers are a fertile and not too acid soil and a fair supply of soil moisture. Where white clover is naturally abundant in paspalum pastures it may be taken for granted that its requirements are supplied, but it is true that the production of thousands of acres of paspalum pasture could be improved by the encouragement of clover growth.

Soils which are distinctly acid can only be made suitable for clover growth by the use of lime. If the fertility of the soil has been lowered by many years of grazing, it is advisable either to renovate with the plough or paspalum renovator and topdress with fertilizers. On suitable areas it may be preferable to plough out the pasture and grow a green manure or some other form of crop prior to resowing the area with a mixture of grass and clover seeds. Renovation and green-manuring practices, in addition to increasing soil fertility, also tend to increase the water-retaining properties of the soil.

In all cases where pasture has been renovated, or where new permanent pastures are to be sown, it is advisable to add clover seed to the pasture. The clovers which have proven themselves of outstanding usefulness for incorporation in permanent pastures are white clover and red clover, and both should be included in permanent pasture sowings on the sub-tropical coast. White clover provides good grazing from about August until November, while red clover makes the bulk of its growth from September till March. Compared with white clover, red clover is a short-lived plant and dies out in a pasture within two or three years. It is of great use, however, in providing feed during the first year while the white clover is establishing itself.

When sowing on renovated paspalum or in new pasture mixtures, about 1 lb. per acre of each of the clovers should be used. New Zealand strains of white clover are superior to European or local strains of which commercial seed its available; the best seed to use is New Zealand Government-certified white clover seed. New Zealand strains of red clover also are preferable to other commercial types.

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PREPARING LAND FOR WHEAT.

Widely distributed rains since December have enabled farmers to go on with the preparation of wheat lands. Fields ploughed during December will now be in good physical condition, provided weed growth has been controlled by judicious cultivation.

Where sheep have access to the fallowed areas weeds will not be troublesome, but elsewhere every effort should be directed towards the eradication of all such growths. If it has been possible to control weed growths, all workings following the initial ploughing can be done entirely with rigid-tine cultivators, or spring-tooth implements, and with harrows. Cultivation to the desired depth in order to break the crust and form a good surface mulch should be done soon after all substantial rains. As a firm seed-bed is required, it is important to progressively reduce the depth of working towards seeding time, particularly where sheep are not available to assist in consolidation.

Well-prepared land containing ample reserves of moisture is often fit for sowing at a seasonable period, according to the variety selected, independently of favourable rains. On the other hand, hurriedly prepared land may have to await later rains to effect germination—a great disadvantage, for early or seasonably sown crops invariably give the best average returns.

Where wild oats and other weeds are assuming pest proportions, it is suggested that the land be sown to a good fodder oat, which can be grazed as required, ploughing in the residue in sufficient time to prevent the maturity of the wild oat seed.

Weed infestations during the following year can thus be greatly reduced, besides providing valuable feed, and a rotation crop of benefit to the land.

CEMENTED BAGS FOR LIGHT FARM BUILDINGS.

The ubiquitous chaff and cement bag can be turned to good account in the building of fowl houses or similar farm buildings of light construction, according to the following plan, which has proved successful in practice.

A framework of timber is first of all built up, after which wheat or cement bags are opened out and stretched very tightly over it, being nailed down with ⅝-inch clout tacks. Next, a mixture is made up as follows:—

Water, 1¼ gallons,
Cement, 12 lb.,
Lime, 2 lb.,
Salt, 1 lb.,
Alum, ½ lb.

(In damp weather use 1 pint less of water.)

Sieve the salt and lime together through a five sieve—to thoroughly mix the materials and get rid of any big lumps—add the water and then the cement—stirring while adding—and finally the alum. Wet the stretched bags with water and apply the mixture without delay, using a fairly stiff brush, first on the outside, and then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside. When this sets, the bags will be quite hard and stiff, somewhat like plaster board. Subsequent coatings will, of course, make a stronger board.

The cost of the process, including bags for the foundations, works out at about 8d. a square yard. From this it will be seen that it is a very cheap and easy method of construction. Sheds built according to this plan three years ago show no signs of disintegration.

ENERGY OF GROWTH IN SEED GERMINATION.

With seed germination tests it is the practice to count off the percentages of seeds which have germinated each day, and to report results as so much percentage in so many days.

The following shows the daily counts of three samples of seed put out to germinate:—

—	Day Percentages.					Total.
	2nd.	3rd.	4th.	5th.	6th.	
						Per Cent.
Sample A	99	..	..	..	..	99
Sample B	45	20	25	..	..	90
Sample C	20	30	40	..	..	90

These figures give the energy of growth, or germination energy.

Obviously Sample A is the best. Although the total germination of B and C are equal, B, by its capacity to get an early start, would be superior to C.

With seeds for sowing, it is necessary to distinguish carefully between mere capacity to germinate and energy of growth. Rapidity and uniformity of germination, so that the roots in their initial stages may become firmly established and the plants may appear above ground with a degree of uniformity, are desirable qualities. Moreover, slow germination and development generally indicate constitutional weakness of the young plants; anything checking their early progress produces conditions favourable for the attack of insects and fungi.

Adverse conditions of weather and soil often destroy all but the vigorous growers.

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FERTILIZER AND MANURE.

Some confusion is often caused by the indiscriminate use of the words fertilizer and manure. Although interpretations or definitions may vary in various parts of the world, in Queensland the terms as implied or defined by the Fertilizers Act have the following meanings:—

Fertilizer is any manufactured or natural substance sold or offered for sale for application to the soil for the use of plants and/or remedying any soil deficiency, and which has been prepared in such a way that it is stable, dry, and in a form fit for storage; if insoluble, it must be ground to the required degree of fineness.

Manure is farmyard, sheep, poultry, or stable manure, or other natural organic material of this type which has not been dried or treated in any way, to render it fit for sale in the ordinary commercial way as a fertilizer.

Horticultural Notes

French Beans.

A CONSIDERABLE variety of beans is grown in Queensland, but certain varieties are outstandingly more popular than others. The Canadian Wonder is an all-round favourite on the market, but because of its susceptibility to disease is not grown to the same extent now as formerly. Brown Beauty is very popular in North Coast districts, where it is known as a hardy and prolific variety. Stayley's Surprise also is grown extensively, and is usually planted two or three weeks earlier than Brown Beauty. Other varieties grown to a lesser extent are Feltham's Prolific and Burnley Selection, the latter being a new variety supposedly blight-resistant.

Plantings may be made at almost any time of the year, depending on local conditions in each district. On the North Coast, on areas free from frost, June and July are the two main months for planting. Other districts prefer spring or summer planting.

In some parts of the State in the past great difficulty has been experienced in raising a crop during the hot months because of the ravages of the Bean Fly, but experiments have shown that it is possible to obtain at least partial control of this pest by spraying. Information on this and other pests and diseases of beans can be obtained on application to the Under Secretary, Department of Agriculture and Stock, Brisbane.

In preparing land for general market garden crops, along with cultivation they generally require the free use of well-rotted stable or other manure, but in the case of beans the application of heavy dressings of such manures often results in the production of an over-abundance of foliage and poor setting of pods. Beans grow best in a well-cultivated soil, and preferably one that has been manured for a preceding crop. Well-drained clayey loams yield the best result.

Fertilizers should be freely used. There are on the market several commercial complete fertilizers for beans, sold by well-known and reputable firms, which can be purchased with confidence. The customary dressing is 6 cwt. to 8 cwt. per acre. It should be applied in the bottom of the drills, covered with about an inch of soil before planting the seed.

Planting is usually done by striking out drills about 6 inches deep and, after applying the fertilizer and lightly covering this with soil, dropping the seed by hand and again raking in a light covering of soil. During subsequent cultivation the drills will gradually fill up. The rows may be 2 feet 6 inches to 3 feet apart, and the seeds spaced 6 inches to 8 inches in the rows. Thirty-five lb. of small and 52 lb. of large seed is sufficient to plant an acre.

Horse cultivation is usually carried out, but it is not advisable to commence this work in the early morning, or at any time when the plants are wet, as the spores of certain diseases are more easily spread under these conditions.

Weeds should be kept in check, as they will seriously affect the growth of the crop.

The maximum output of beans can only be gained by picking thoroughly as they become fit, that is, when young and tender; otherwise then will begin to form seed, and the plants will cease to bear marketable beans.

APPLE AND PEAR VARIETIES.

Orchardists in the Stanthorpe District who may be planning a planting programme for the coming season are advised to place their orders with reliable nurserymen without undue delay. Early ordering ensures early delivery of the young trees.

As regards varieties to plant, the Granny Smith is likely to be the best commercial apple for many years to come. If reasonably well treated, it will give a good crop every year.

Some growers are inclined to think that the market will be overloaded with Granny Smith apples when young trees already planted come into bearing. This is not likely to happen.

The Stanthorpe Granny Smith is equal to if not superior to any grown in the Commonwealth. The keeping qualities are good, and far more should be cool-stored than at present. Stanthorpe apple-growers should try to supply the requirements of their own State with Queensland-grown apples as long as possible by using the available cold-storage facilities.

If the Granny Smith crop in the Stanthorpe district were doubled, or even trebled, there should be no difficulty in marketing the fruit at existing or even enhanced prices.

In addition to the Granny Smith, which should be the main variety, Delicious, Lalla (Red Delicious), Winesap, and Red Statesman are good types.

Red Statesman, and, in addition, Dougherty are eminently suitable for the late "private order" trade. Growers who specialise in this trade should cater for their customers over as long a period as is possible. Stocks are frequently exhausted long before they should or need be, and then supplies have to be drawn from elsewhere.

The Gravenstein is a good early dessert apple well worth growing. On account of its susceptibility to gnarl or twist, it is advisable to grow a scaffold tree of another strong-growing variety, such as Delicious, and then rework with Gravenstein scions from selected trees free from the trouble.

Growers should be wary of planting new varieties of apples. Generally it is a good plan to plant only standard varieties and let someone else do the experimenting. Though new varieties may have good characteristics, they are seldom better than those already grown, and, being unknown to the trade or the householder, the fruit is viewed with suspicion and is difficult to market.

As regards pears, the best commercial varieties are Williams Bon Cretien, Packhams, Triumph, and Beurre de Box—all are good growers and croppers.

The Winter Cole is a late-maturing variety which is popular in the other States. Stanthorpe growers should, however, limit their plantings of this variety on account of possible fruit fly attacks at the end of the season.

SUBSTITUTE BUNCH COVERS IN BANANA RUST THRIPS CONTROL.

During recent years, paper tubes have been used in some districts as bunch covers for the protection of bananas. In the winter months particularly, when the plants are partly defoliated and the fruit fills out slowly, the tubes reduce the amount of wastage due to sun scald and cracking, which are associated with harsh climatic conditions. They also promote better filling of the fruit.

The possible utility of these tubes as substitutes for the hessian bags which are essential in the recommended measures for banana rust control thus merits consideration. The present recommended control measures prescribe close meshed ''sugar'' hessian covers for the bunch and weekly dustings with a nicotine dust for a period of four weeks. At the present time hessian is somewhat expensive, and the market is short of supplies. Substitute materials are thus a matter of importance to the banana grower. Recent investigations at Nambour have shown that paper tubes can be almost as efficient as hessian bags in the thrips control programme, under conditions of moderate rust infestation. This holds true only if the tubes remain intact during the growth of the bunch. The tubes must therefore be made from strong paper with sewn rather than gummed seams. They must also be large enough to comportably cover the mature bunch without pressure from the outstretched hands of fruit.

In practice, then, the grower may use paper tubes in his covering plus dusting programme for rust control, proceeding in much the same way as the standard recommendations prescribe. Thus, the tube would be fitted to the bunch as soon as it is thrown, a nicotine dust then being applied through the lower opening. Further dustings would similarly be given at weekly intervals during the next three weeks.

In order to simplify both dusting and harvesting, the tubes should be distinctly branded with symbols to show the approximate date on which the bunch was thrown. Letters (for the month) and numbers (for the week in the month) have proved suitable; thus "J.1." would indicate a bunch thrown in the first week of January, and "M.3." a bunch thrown in the third week of March. From these brands, the grower can see at a glance which bunches require dusting. He will also know, from his knowledge of the plantation, the approximate date on which the bunch should be cut. No time is lost in examining half mature bunches, and once a bunch is seen to be nearing maturity, some of the leaves can be pulled down to assist in finding it again in later cutting rounds.

LETTUCE GROWING.

Lettuce is one of the most popular vegetables, and with regular sowing and care in cultivation it may be grown the whole year round. In Queensland, the best times for planting are the late summer, autumn, and winter.

Lettuce is a vegetable that must be grown quickly to ensure crisp leaves. If a check is received during growth the leaves acquire a slightly bitter taste, which tends to decrease the market value of the plants. This defect is more prevalent during the late spring, early summer, and autumn plantings.

The soil should be well cultivated, and it is desirable that, where possible, large quantities of well-rotted farmyard manure be incorporated with the soil. Should fresh manure be used some time should elapse before planting.

Lettuce may be grown in a seed-bed and transplanted into rows, allowing 12 inches between the plants. The seed may also be sown directly into the row and the plants later thinned out to the required distance.

Sow the seed thinly and cover lightly with fine soil, and then firm the ground gently.

During the growing period the soil around the plants must be kept cultivated, but care must be taken not to allow any soil to get on or into the hearts of the plants. Constant watering is essential and the soil should never be allowed to dry out. Should the plants appear to be growing slowly an application of liquid manure would be beneficial, or, failing this, a top-dressing of nitrate of soda or sulphate of ammonia at the rate of 1 to 2 cwt. per acre. These fertilizers should be spread lightly over the ground, but under no circumstances on the plants.

Lettuce should be marketed as soon as possible after cutting, as they deteriorate in quality very quickly.

The cabbage type of lettuce is the popular one in Queensland, and should be cut for market as soon as possible after hearting. For home use lettuce may be used earlier.

Popular varieties for planting are:—

New York or Neapolitan.—A very large variety, best suited for planting in the cooler months.

Iceberg.—A large, good-hearting variety, with crinkled leaves and pink tips, suitable for planting in warm weather.

A pamphlet on packing of lettuce for market is obtainable free on application to the Department of Agriculture and Stock.

MARKING CASES.

Banana-growers are reminded of the necessity of marking legibly on each end of the case the variety of banana contained therein when forwarding on to the Victorian market.

To assist growers, the approved abbreviation of each variety is given hereunder:—

Name of Variety.	Abbreviation.
Cavendish	Cav.
Williams Hybrid	W.H.
Mons Marie	Mons
Veimama	Vma.
Samoan China	S.Ch.
Lady's Finger	L.F.
Manilla	Mnl.
Pear	Pear
Sugar	Sug.
Plantain	Ptn.
Laubin, Lobin, or Lubin	Lbn.
Gros Michel	G.M.

The regulations require that the name of the variety shall be in letters of not less than three-quarters of an inch in height if stencilled on the packages, and not less than one-quarter of an inch if printed on a label or sticker.

Growers, therefore, should brand all cases of bananas forwarded to the Victorian markets with the name of the variety.

REWORKING DRONE CITRUS TREES.

In orchards where undesirable types of citrus trees have been cut back for re-working, the final thinning of shoots not required for budding into may be done. Where necessary, the trunks and limbs should be re-whitewashed to continue protection from sunburn. In districts where the growth of new shoots is sufficiently advanced (they should have attained a diameter of some ⅜ inch at the base), and providing that the sap is flowing freely, they may be budded.

When the shoots are ready to receive the bud, a perpendicular cut is made in the bark at or near the base. The cut should be from 1 to 1½ inches in length, and in depth through to the cambium layer. Another cut is then made horizontally across the top of the perpendicular one, so that the two together form a T.

Budwood should be taken only from selected trees which are healthy and vigorous and noted for consistent production of heavy crops of quality fruit. Budwood should be well rounded, mature wood about the thickness of an ordinary lead pencil or slightly less and not more than one year old. Before the buds are cut from the budstick, the leaves are trimmed off so that a piece of the leaf stalk or petiole is left in each case. By this means the bud can be more easily handled after cutting.

The bud may be cut off the stick either from above or below, but the general practice is to cut from below the bud upwards, commencing about half an inch below and ending about half an inch above. The cut must be made with a sharp, thin-bladed knife, and be just deep enough to remove a very thin layer of wood. In the absence of thorns, the wood may be carefully removed from behind the bud, care being taken not to damage the bud.

The bud is then inserted down and under the bark of the stock by raising the latter with the budding knife. In order to bring the bud and stock in close contact, they are bound tightly together with a raffia tie. In from two to three weeks the bud, if it remains green, will have taken—that is to say, united with the stock. The tie may then be cut and the head shortened back to force the sap into the bud. The stub may be utilized to support the shoot from the bud during its early growth, but when the shoot has made good growth and is strong enough to support itself the stub should be removed altogether.

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A SEASONAL REMINDER TO CENTRAL QUEENSLAND TOMATO-GROWERS.

If tomato seedlings are sought from outside sources, they should be obtained from reliable growers offering varieties true to type and free from crop-reducing pests and diseases. Correct attention to the seed-bed is of paramount importance in the production of strong, healthy plants. Hygienic practices in the seed-bed will greatly assist in reducing losses from diseases and pests.

When preparing the seed-bed, select a small area of newly-burnt virgin scrub land on which no lantana has previously grown. Level or slightly sloping ground is preferable. Oblong beds just wide enough to permit the grower to reach to the centre without undue exertion are advisable. They should be dug to the depth of an ordinary garden fork, and raised about 4 inches above the natural surface of the ground to ensure drainage. The soil in the beds should be reduced to a fine tilth and the surface levelled and firmed with the back of a spade before sowing the seed. When seed has been evenly and not too thickly scattered over the beds, cover lightly with fine soil. Treatment of seed with a solution of corrosive sublimate before sowing is a desirable practice. Information on seed treatment methods may be had on application to the Department of Agriculture and Stock.

To assist even germination of seed, the bed may be lightly covered with dry grass or hessian. Should hot sunshine prevail after the young seedlings appear, remove the covering from immediately above them to a higher level on a framework made with light forked sticks and crosspieces.

Harden the developing plants, so that they can withstand conditions in the field, by gradually reducing the grass or hessian covering until they are fully exposed to the sun for a short period before transplanting. Frequent watering of the seed-bed to maintain an even and ample soil moisture condition is essential. During the time the young plants are growing in the seed-bed they should be sprayed and dusted as a safeguard against pests and diseases. A 2-3-40 formula of Bordeaux spray mixture is recommended as a control of tomato plant diseases in seedlings. The chief seedling pest is the tomato mite, for which dusting with a good grade of dusting sulphur is recommended. The sulphur may be conveniently applied with a dust gun or by shaking it over the seedlings from a sugar-bag or some similar container which allows the dust to filter through the mesh.

When plants have grown to a height of 6 or 7 inches, they are ready for transferring to their permanent location in the field. In removing plants from the seed-bed, care should be exercised to ensure the minimum amount of damage to root hairs during the operation. A thorough wetting of seed-beds before removing plants will greatly assist in reducing undue disturbance of the root system.

A convenient tray for the transport of seedlings from the seed-bed to the field can be made with a shallow box and by affixing two small uprights and nailing a cross-piece between them at the top to serve as a handle. Such a tray will protect plants against damage during transplanting operations.

Sowing seed directly into permanent positions within the field has advantages where irrigation can be practised or where good soil moisture conditions obtain, but it is not a recommended practice for the Central district, because of the unreliability and erratic nature of the rainfall.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

APRIL.

Pittsworth	2nd and 3rd
Millmerran	5th
Toowoomba	15th to 18th
Dalby	22nd and 23rd
Chinchilla	26th and 27th
Kingaroy	30th April and 1st and 2nd May
Tara	30th April and 1st May

MAY.

Miles	1st
Monto	1st and 2nd
Yarraman	3rd, 4th, and 6th
Millmerran Rodeo	6th
Longreach	6th to 8th
Mundubbera	8th and 9th
Beaudesert Show	8th and 9th
Beaudesert Campdraft	10th and 11th
Nanango	9th to 11th
Blackall	13th and 14th
Roma	14th to 16th
Gayndah	15th and 16th
Mitchell	15th and 16th
Murgon	16th to 18th
Warrill View	18th
Ipswich	21st to 24th
Goomeri	23rd and 24th
Biggenden	23rd and 24th
Baralaba	23rd and 24th
Baralaba Rodeo	25th
Kalbar	25th
Gympie	30th and 31st and 1st June
Lowood	31st May and 1st June

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	23rd to 25th
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Atherton	6th and 7th
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Rocklea	14th
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

STONE fruits are now well in season. Many Stanthorpe lines are showing signs of the hail visitation, which made some very excellent quality fruit into second grade. In spite of this high prices have prevailed throughout the month, weather conditions being in favour of a continued strong demand.

Mangoes and papaws are in full supply and are of excellent quality. High prices are being maintained, possibly due to the shorter supplies of stone fruits.

Pineapples are in light supply and high prices are being realized.

Growers should consider shipping to the South all tropical fruits now that the hot weather is with us. Some good lines of papaws have been noticed on the Brisbane markets with fruit in an over-ripe condition, due to being allowed to advance too far before harvesting. These lines have to be repacked, with consequent loss to the growers.

The following were the ruling market prices during the last week of the month of January, 1940:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: small, 4s. to 9s.; sixes, 7s. to 10s. 9d.; sevens, 8s. to 10s. 6d.; eights and nines, 6s. to 13s. 6d.

Sydney.—Cavendish: sixes, 8s. to 12s.; sevens, 12s. to 15s.; eights and nines, 15s. to 18s.

Melbourne.—Cavendish: sixes, 10s. to 11s.; sevens, 12s. to 13s.; eights and nines, 14s. to 15s.

Adelaide.—Cavendish: 19s. to 21s. per case.

Lady's Finger, 2d. to 8d. per dozen.

Sugars, 1½d. to 5d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 2s. to 5s. per dozen; 3s. to 6s. per case. Ripley, 6d. to 2s. 6d. per dozen; 3s. 6d to 7s per case.

Sydney.—Smoothleaf, 7s. to 12s.

Melbourne.—Smoothleaf, 8s. to 12s.

Adelaide.—Smoothleaf, 14s. to 15s.

Green fruit unsalable.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. per tropical case; local, 2s. to 3s. 6d. per dump case.

Sydney.—10s. to 16s. per tropical case.

Melbourne.—6s. to 10s. per tropical case.

Mangoes.

Brisbane.—Fancy varieties, 4s. to 8s.; common, 2s. to 6s.

Sydney.—8s. to 10s. half-bushel.

Melbourne.—16s. to 18s. bushel.

Passion Fruit.

Brisbane.—Firsts, 8s. to 11s.; seconds, 5s. to 6s.

Melbourne.—10s. to 14s. half-case.

OTHER TROPICAL FRUITS.

Figs.

8d. to 9d. box; 2s. to 3s. tray.

CITRUS FRUITS.

Oranges.

Brisbane.—18s. to 22s. bushel.

Grapefruit.

Brisbane.—Palestine, 35s. per export case.

Lemons.

Brisbane.—Gayndah, 14s. to 22s. bushel; locals, 8s. to 17s. bushel.

Melbourne.—14s. to 22s. bushel; imported, 50s. to 52s. per export case.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Yates, 9s. to 14s.; Granny Smith, 6s. to 8s., specials to 12s.; Gravenstein, coloured, 10s. to 16s.; Gravenstein, green, 6s. to 8s.; Stanthorpe cookers, 4s. to 6s.

Sydney.—Jonathan, 12s. to 15s.; Granny Smith, 9s. to 12s.

Pears.

Brisbane.—W.B.C., 5s. to 9s.

Peaches.

Brisbane.—Elberta, 5s. to 7s.; Wiggins, 4s. to 8s.; others, lower.

Nectarines.

Brisbane.—5s. to 8s.

Plums.

Brisbane.—Angelina, 10s. to 14s.; Black Diamond, 4s. to 7s.; October Purple, 8s. to 10s.; Doris, 8s. to 12s.; Ponds, 8s. to 12s.; others, 5s. to 10s.

OTHER FRUITS.

Grapes.

Brisbane.—White, 2½d. to 4d. lb.; Cominya, 5s. to 6s. case; black, 3d. to 4d. lb.; Roma muscatels, 8s. to 10s. case; muscatels, 5d. to 6d. lb.

Tomatoes.

Brisbane.—Ripe, 1s. to 3s.; coloured, 3s to 5s.; green, 1s. 6d. to 3s. 6d.

MISCELLANEOUS, VEGETABLES, &c.

Watermelons.—Small, 2s. to 4s. dozen. Choice, 5s. to 10s. dozen. Large, higher.

Cucumbers.—2s. to 4s. bushel.

Pumpkins.—*Brisbane:* 4s. to 5s. 6d. bag. *Sydney:* 5s. to 9s. bag.

Marrows.—*Brisbane:* 6d. to 2s. dozen.

Lettuce.—1s. 6d. to 4s. dozen.

Cabbages.—*Local:* 1s. to 7s. *Stanthorpe:* 6s. to 8s.

Beans.—*Brisbane:* 2s. to 4s. sugar bag.

Peas.—*Brisbane:* 4s. to 5s. sugar bag. *Imported:* 4s. to 11s. per ½ cwt.

Beetroot.—3d. to 10d. bundle.

Parsnips.—3d. to 9d. bundle.

Carrots.—3d. to 1s. 3d. bundle.

Rhubarb.—6d. to 1s. 3d. bundle.

Registered and Rejected Stallions.

REGISTERED STALLIONS.

Subjoined is a list of stallions in respect of which Certificates of Registration were issued under *"The Stallions Registration Acts,* 1923 *to* 1934," during the year 1939-40:—

BLOOD STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939-40.

Name.	No.	Age.	Colour.	Owner.
Alcmond	2312	Aged	Brown	A. H. Tanzer, Abercorn
Ankobar	2355	6	Chestnut	L. S. V. Oxley, Wilga Vale, Yelarbon
Anorient	2415	5	Black	S. G. Collins, Strathmuir
Arabask	2356	Aged	Bay	D. R. Hutton, Cunningham
Banker	2313	5	Brown	N. Edwards, Gympie
Billie's Willie	2314	6	Dark bay	J. F. Mylett, Nanango
Brightlights	2440	5	Chestnut	J. Y. Shannon, Rodney Downs, Ilfracombe
Brownleigh	2416	Aged	Brown	A. Baxter, Alton Downs, Rockhampton
Crownlea	2393	Aged	Brown	J. Camilleri, Wood street, Mackay
Deer Hunt	2441	6	Chestnut	C. Bradley, Mundubbera
Direct Laddie	2442	5	Brown	W. S. Carter, Hendra
Duke Heroic	2394	Aged	Bay	A. H. W. Cunningham, Strathmore
Fern Coolin	2357	5	Black	P. A. Wright and Sons, Kindon, Goondiwindi
Garrio	2311	Aged	Bay	F. J. C. Martin, Kumbarilla
Glen Esk	2444	5	Chestnut	J. C. Webb, Manson road, Hendra
Golden Wisdom	2445	5	Brown	B. J. Keiran, Breakfast Creek
Good Lad	2467	5	Brown	F. P. Wieland, Herberton
Great Scott	2395	5	Chestnut	F. A. Ross, Waitara, Nebo
Grey Craft	2396	6	Grey	A. F. Butterworth, Nebo
Heckler	2468	6	Brown	Wharton and Longwell, Lolworth
Homevale	2397	6	Chestnut	Bell and Co., Croydon, St. Lawrence
Idol Answer	2315	6	Brown	R. Webb, Childers
Javalot	2446	5	Bay	A. Jarvis, Cracow
Khyber	2447	5	Chestnut	B. C. Bell, Boonah
King's Command	2448	5	Brown	B. J. Wagner, Brighton terrace, Sandgate
Lavender	2337	Aged	Bay	J. H. Summerville, Kholo, *via* Ipswich
Lord Hazrat	2316	Aged	Brown	W. L. Savage, Fernbank, Kingaroy
Lord Nelson	2449	5	Brown	Anderson and Gargett, Hendra
Mark Antony	2466	6	Black	W. T. Kelly, Brisbane
Matanta	2298	5	Bay	C. W. Persse, Warra
Melody Mac	2299	Aged	Bay	W. J. Butler, Toowoomba
Merry Felt	2450	5	Brown	J. Leahy, Kinbombi
Mr. Felt	2451	5	Brown	J. H. Walker, Oakey
N.E.F.	2398	Aged	Bay	A. H. W. Cunningham, Strathmore
Noble Son	2452	5	Bay	C. H. Skuse, Grafton street, Warwick
Oak Listowel	2358	Aged	Bay	R. J. Glasby, Goondiwindi
One Star	2453	5	Brown	W. Hennessy, Harding street, Hendra
Oxford	2399	Aged	Brown	Estate E. G. Lascelles, Goorganga
Parth	2437	6	Chestnut	J. S. Moorehead, Armidale
Pavonian Prince	2417	5	Chestnut	E. T. Kelly, Glen Isla, Kunwarara
Phar Chip	2418	Aged	Bay	J. F. Rowe, Nagoorin
Plain Persse	2382	5	Chestnut	C. Elleray, Beaudesert
Pleiades	2454	5	Brown	Estate H. J. Winten, Rosalie Plains
Polyveil	2317	6	Chestnut	M. McDonnell, Gympie
Prince Veil	2455	5	Brown	Gibson Bros., Gunnadorah, Quilpie
Quasimodo	2318	Aged	Chestnut	G. C. Tye, Cynthia
Red Jim	2400	5	Chestnut	Wallis and Wright, Nebo
Resilguard	2419	5	Chestnut	S. and D. Urquhart, Baralaba
Rewan Lad	2420	Aged	Brown	Woorabinda Aboriginal Settlement, Woorabinda
Roman Castle	2456	5	Brown	T. J. Evans, Stanley street, Coorparoo
Roynissa	2421	5	Chestnut	G. P. Winslade, Pink Lily, Rockhampton
Rufus	2401	5	Chestnut	A. D. Shannon, Oxford Downs, Nebo
Sarchedon Lad	2422	6	Bay	B. McCamley, Bajool
Secret Air	2338	5	Chestnut	H. C. Spletter, Dugandan
Semetic	2457	Aged	Brown	A. R. Olive, Brigg's road, Ipswich
Serecirclet	2402	6	Chestnut	A. H. W. Cunningham, Strathmore
Shellawong	2463	6	Bay	J. C. Cadell, Charleville
Silver Gift	2458	5	Bay	J. B. Shannon, Tooloomba, St. Lawrence
Sir Magnum	2339	6	Black	J. Griffiths, Coochin, Boonah
Some Day	2319	5	Brown	R. E. Pickels, Coolabunia
Somerset	2340	Aged	Grey	W. Armstrong, Glencoe, Esk
Spearon	2359	Aged	Bay	T. Jennings, Greenmount
Sternula	2403	Aged	Black	A. H. W. Cunningham, Strathmore
Substitute	2459	5	Bay	W. Allen, Brisbane
Sunstream	2460	5	Brown	J. Y. Shannon, Rodney Downs, Ilfracombe
Superspear	2461	5	Brown	J. Y. Shannon, Rodney Downs, Ilfracombe
Twig	2469	Aged	Bay	Cashmere Pastoral Co., Cashmere
Valley Glen	2462	5	Chestnut	W. G. Peters, Glenore Grove
Walla Spear	2423	Aged	Bay	Julia J. Chapman, Calliope
Warwick Lad	2341	6	Bay	G. A. Heise, Minden
Whitenose	2470	Aged	Black	R. Jenkins, Julatten
Young Pasha	2424	Aged	Grey	J. R. White, Belmont Park

PONY STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939–40.

Name.	No.	Age.	Colour.	Owner.
Abdul	2360	6	Grey	H. M. Cunningham, Redgate, Stanthorpe
Black Jewel	2342	5	Black	A. Anderson, Teape street, Silkstone
Black Prince	2323	5	Black	A. J. Manning, Mondure
Bosca	2308	5	Creamy	J. W. G. Taylor, Newstead, Warra
Comet	2325	5	Brown	A. F. W. Pool, Charlestown, Wooroolin
Faraam Prince	2383	5	Grey	K. Hargraves, Coomera
Grey Boy	2438	5	Iron grey	V. P. Walsh, Nanango
Little Jim	2343	5	Bay	W. L. Clem, One-mile Estate, Ipswich
Master Signet	2361	5	Bay	F. Burns, College road, Stanthorpe
Patches	2309	6	Skewbald	L. O'Brien, Highfields
Pidgeon	2434	Aged	Bay	W. J. Ferguson, Kokotunga
Playboy	2411	Aged	Creamy	B. Cole, Walkerston
Prince Reuben	2310	5	Bay	H. A. Ruhle, Oakey
Shaza	2297	5	Iron grey	Jean Thomas, Russell street, Toowoomba
Silver King	2324	5	Chestnut	Ed. Litfin, Mount McEwan, Mondure
Silver Thread	2435	5	Taffy	F. W. Tully, Mount Larcom
Simple Jim	2362	Aged	Bay	L. Thompson, Stanthorpe
Sparkler	2322	5	Chestnut	S. B. Trigger, Lakeside
Tommy	2384	5	Iron grey	E. V. Dwyer, Pomona
Wee Jim	2363	5	Chestnut	R. A. Newman, Goondiwindi

TROTTER STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939–40.

Broadwood	2320	5	Bay	A. C. Underwood, Tingoora
Cobba-da-mana	2305	5	Black	P. Hughes, Macdonaldtown, Toowoomba
King Broad	2321	5	Bay	G. H. Woodall, Boonenne, Kingaroy
King David	2344	5	Black	P. Staines, Milbong
Sparkling Wilkes	2306	5	Black	E. Darr, Mount Irving
Steel Globe	2465	Aged	Grey	G. H. Adams, Chelona, Mackay
Win Direct	2307	6	Black	E. Fox, Gray street, Toowoomba

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939–40.

Abbotsford Chancellor	2439	Aged	Black	Forge Bros., Tamworth
Afton	2471	Aged	Bay	Longton Station, *via* Pentland
Alan	2404	5	Brown	Estate E. G. Lascelles, Goorganga
Arolla's Heir	2364	5	Bay	D. Ryan, Allora
Balwherrie Intent	2326	5	Bay	F. Tucker, Ellesmere, Kingaroy
Balwherrie Intention	2472	Aged	Brown	Trustees J. Allingham Estate, Southwick
Barron Bold	2473	5	Bay	Cashmere Pastoral Co., Cashmere
Benowrie Chief	2327	5	Black	E. W. Tye, Cynthia
Berriew Premier	2436	5	Bay	F. D. Arthur, Helidon
Black Boy	2405	5	Black	Estate E. G. Lascelles, Goorganga
Blue Prince	2406	5	Blue grey	Mrs. M. McAfee, Gumlu
Bluff	2474	5	Bay	W. R. Trembath, Paxton street, Townsville
Bold Exchange	2328	5	Bay	H. V. Petersen, Kolan River South
Bold March	2329	6	Bay	L. W. Horne, Takura
Brittany Intent	2475	5	Black	Hy. Orr, Sala Siding
Bully Bar	2425	5	Bay	V. R. Katte, Dingo
Captain	2300	6	Bay	D. G. J. Stone, Miles
Captain	2426	5	Bay	W. J. White, Milman
Captain	2427	5	Bay	C. T. Johnson, Gracemere
Carlvale	2365	6	Bay	M. O'Leary, Wheatvale
Ceren Chief	2476	Aged	Bay	Cashmere Pastoral Co., Cashmere
Clematic Bold Prince	2330	Aged	Bay	R. Stark, Wondai
Clifton Sunray	2428	6	Bay	P. Egan, Rockhampton
Cornish Laddie	2345	6	Bay	H. O. Meischke, Grantham
Cowley	2366	6	Bay	G. F. W. Goodrich, Inglewood
Crystal Tide (Imp.)	2367	Aged	Bay or brown	W. P. Canning, Tannymorel
Dale Pride	2346	5	Bay	A. R. Zischke, Hatton Vale
Dark Chief	2477	5	Black	H. Webb, Reid River
Don	2368	5	Bay	W. A. Lyell, Bony Mountain, Cunningham
Doolin Carlyle	2369	5	Bay	W. Tonissen, care of J. Rickert, Elphinstone
Douglas Credit	2370	Aged	Black	C. E. Lack, Back Plains
Duke of Windsor	2385	5	Bay	C. J. Maas, Waterford
Emu Valley	2487	5	Dapple grey	F. M. Trembath, Charters Towers
Eumara Valley	2488	5	Bay or brown	F. M. Trembath, Charters Towers
Fairview Great Hope	2491	Aged	Brown	J. M. Smith, Melbourne
Fairymead Baron Knight	2371	6	Bay	J. P. Warden, Goondiwindi
Fairymead Bold Lorraine	2430	5	Bay	H. C. Dougall, Littlemore
Gindie Lad	2478	Aged	Chestnut	J. F. Quilter, Tolga
Glenmore II.	2431	5	Black	Mrs. A. E. Ziebarth, Biloela
Jollie Gloucester	2386	5	Bay	S. O. Mear, Carrington road, Toowoomba
Kelso Marshall	2479	Aged	Bay	Cashmere Pastoral Co., Cashmere
Kerrston's Ideal	2432	6	Black	Archer Bros., Gracemere
King Billy	2387	5	Bay	A. Bishop, Caboolture
Knight Superb	2331	5	Bay	H. Norgrove, Bundaberg
Lad	2332	5	Bay	W. J. Murphy, Lower Wonga
Lincoln	2407	Aged	Brown	G. Bonaventura, Eton
Lion	2347	5	Bay	W. Frohloff, Upper Yarraman
Loyal Carlisle	2372	5	Black	W. Doro, Glassy Mountain, Pozieres
Major	2333	5	Bay	C. A. Taylor, Brooloo

DRAUGHT STALLIONS CERTIFICATED FOR LIFE DURING YEAR 1939–40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Major Wallace	2408	5	Bay	W. H. Gillham, Suttor Creek, Nebo
March On	2334	5	Bay	C. E. Pascoe, Ceratodus
Master Dale	2348	6	Bay	E. J. Weigel, Thornton
Maxwell	2349	5	Bay	M. W. Kruger, Coleyville
Montie	2433	Aged	Bay	R. T. Cross, Marmor
Navillus Extent	2388	5	Black	B. T. Smiles, Palen Creek
Nelson	2480	Aged	Bay	W. R. Trembath, Paxton street, Townsville
Nobby	2409	Aged	Brown	P. H. Atherton, Koumala
Oxford Don	2335	5	Bay	S. J. and C. Jenkins, Theebine
Palomar King	2381	Aged	Bay	H. J. Crothers, Dirranbandi
Play Boy	2410	Aged	Bay	Mrs. S. Bidgood, Gumlu
Prince	2350	5	Bay	W. T. D. King, Neurum
Prince	2351	5	Bay	D. B. O'Day, Linville
Prince	2481	5	Grey	A. J. Buck, Baringha
Prince	2412	5	Bay	A. Carena, Inneston
Prince of Hillview	2389	6	Bay	E. W. Hill, Hillview
Punch	2373	6	Bay	J. J. Keleher, Pratten
Punch	2390	5	Bay	P. Sultmann, Woongoolba
Punch	2482	5	Black	J. J. E. Hillier, Brandon
Red Robin	2374	5	Bay	W. A. Deacon, Allora
Rich Lad	2336	5	Bay	A. C. H. Marquardt, Mondure
Royal Carline	2375	5	Bay	J. E. Lysaght, Maryvale
Royal Kerrston	2391	5	Brown	W. and S. Welk, Nambour
Royal Pride	2490	5	Dark bay	Cashmere Pastoral Co., Cashmere
Scottish Farmer	2352	5	Bay	J. B. Pennell, Kalbar
Sergeant Bruce	2302	5	Bay	A. J. Kruger, Goombungee
Sherlock	2353	6	Bay or brown	G. A. Wieland, Boonah
Sir Lisle	2413	Aged	Bay	A. H. W. Cunningham, Strathmore
Speewar Chief	2392	Aged	Bay	J. Cosgrove, Samford
Squaredale Pride	2376	5	Bay or brown	B. A. Hoffman, Emu Vale
St. Ninian's Royal Slade	2377	5	Black	P. Fogarty and T. O'Rourke, Headington Hill, Clifton
Studleith Premier Lad	2483	Aged	Bay	Cashmere Pastoral Co., Cashmere
Sturgon	2484	5	Brown	L. Stallan, Long Pocket, Ingham
Talgai Duke	2303	5	Bay	J. D. Learmonth, Hillview, Pittsworth
Talgai Warrior	2485	5	Bay	J. Kelso, Box 389, Townsville
Tent Hill Victory	2354	5	Bay	W. H. Grams, Upper Tent Hill
Victoria Pasha	2486	6	Dark bay	J. Godfrey, Kairi
Wallace Lad	2378	Aged	Bay	Teresa Nolan, Freestone
Wattlebank Sensation	2414	5	Brown	Wagner and Co., Marylands, St. Lawrence
Wellburn Punch	2301	5	Bay	J. Wharram, Wellburn, Jandowae
Westphalia Laddie	2379	5	Bay	T. J. Turkington, Pilton
Woolamia Lionel	2380	5	Bay	W. Gunn, Kildonan, Goondiwindi
Young Ngapuna	2304	6	Bay	A. J. Harris, Yarranlea

BLOOD STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Black Beau	1862	4	Bay or brown	F. W. Stenzel, Minto Vale
Bright	1907	4	Bay	J. A. Collett, Box 8, Pomona
Cannon Fly	1812	4	Chestnut	S. Otto, Bum Bum Creek, Crow's Nest
Capple Bar	1839	4	Brown	H. G. Stockill, Proston
Clansman	1917	4	Brown	Cook and Cook, Wandoo, Nebo
Elope	1937	4	Bay	H. W. Kirkwood, Ingham
Flying Cloud	1840	4	Brown	T. A. Bellotti, Murgon
Gold Dust	1863	4	Bay	A. H. Kunde, Hazeldene, Kilcoy
King Rufus	1813	4	Bay	F. J. Turner, Irvingdale, Chinchilla
Last Eiffel	1892	6	Grey	S. L. Moore, Goondiwindi (Provisional)
Mannar	1841	4	Chestnut	W. Titmarsh, Yerra
Pavokoff	1918	4	Bay	W. H. Bell, Nebo
Pentator	1814	4	Bay	J. Banks, Wandoan
Pollytrone	1864	7	Bay	F. E. G. Pullen, Station street, Toowoomba (Provisional)
Rivory	1923	3	Bay	H. A. Burgess, Miriam Vale
Royal Mace	1865	4	Bay	E. G. Bell, Box 5, Toogoolawah
Saracen	1919	4	Blue grey	W. H. Gillham, Suttor Creek, Nebo
Warpaint	1893	6	Bay	G. V. Walker, Maryvale (Provisional)

PONY STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Black Prince	1867	3	Black	J. C. Davey, Gatton
Braw Lad	1929	4	Brown	C. Cotter, Ipswich
Bright Gay Lad	1868	3	Bay	F. Huth, Haigslea
Cabulcha Cinnabar	1928	4	Chestnut	J. M. Newman, Caboolture
Cabulcha Quicksilver	1915	3	Bay	J. M. Newman, Caboolture
Cannon Lad	1916	3	Bay	Mrs. K. Cox, Fourth avenue, Sandgate
Dickie Boy	1869	4	Black	B. J. Friske, Blenheim, Laidley
Don	1834	3	Bay	J. C. Naumann, Frogmore, Pittsworth
Gold Cuffs	1894	4	Taffy	E. E. Belford, Wilga Park, Texas
Image	1844	3	Dark bay	J. R. Perrett, Mount Hope, Kingaroy
Jeepere Creepers	1924	4	Brown	W. C. Geddes, Glen Geddes
Jubilee	1870	4	Black	E. Clarke, Thornton, *via* Laidley
Master Don	1835	4	Black	W. J. Smith, Pittsworth
Mecca's Choice	1871	4	Bay	P. J. Connole, Helidon
Playmate	1873	4	Black	R. W. Pitman, Mulgowie

PONY STALLIONS CERTIFICATED FOR THE YEAR 1939–40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Rocket	1836	3	Steel grey	F. W. Pukallus, Murra Murra, Crow's Nest
Sheik	1845	4	Grey	R. B. Jefferies, Murgon
The Imp	1895	4	Dappled grey	A. J. Savage, Gore
Theo	1837	4	Creamy	E. G. Lister, Shenstone, Warra
Tim	1846	4	Grey	B. N. Trott, Mundubbera
Tommy Dod	1874	3	Chestnut	J. C. Logan, Gatton
Walker Pride	1875	3	Bay or brown	Mrs. E. C. Hayes, Harrisville
Warpaint	1876	4	Piebald	H. Badrick, Forest Hill
Wee McGregor	1838	4	Creamy	G. H. Ruhle, Mount Irving
Young Cygnet	1896	3	Bay	P. H. Elks, Stanthorpe

TROTTER STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Name.	No.	Age.	Colour.	Owner.
Billy Wilkes	1914	4	Bay	W. F. Ludwig, Loganlea
Broad Wilkes	1842	3	Chestnut	F. Tucker, Ellesmere, Kingaroy
Sparkling Arrow	1833	4	Black	T. Walker, Maclagan
Stormalong	1843	4	Brown	T. Mancktelow, Mondure
Teddy's Pride	1866	3	Cream	A. Wendt, Marburg

DRAUGHT STALLIONS CERTIFICATED FOR THE YEAR 1939–40.

Name.	No.	Age.	Colour.	Owner.
Abbey's Gift	1815	4	Bay or brown	J. V. Willis, Meringandan
Admiral Gaiety	1877	4	Bay	Boyle and Winks, Harrisville
Altacraig Lustre's Dignity	1930	4	Brown	J. Hunter, Mulgowie
Ballymena Intent	1816	3	Brown	McCullough Bros., Rocky Creek
Balmedie Superb	1817	4	Brown	Mrs. R. V. Breydon, Haden
Balwherrie Intent's Chance	1897	4	Bay	W. Sprott, Pilton
Banker	1847	4	Bay	W. Taylor, Gayndah
Bobs	1898	3	Bay	J. Buckley, Rosehill, Warwick
Bold Dignity	1818	4	Bay	G. and H. Tewes, Pittsworth
Boomer	1848	3	Light brown	F. Brazier, Tingoora
British Prince	1849	3	Bay	W. J. Brims, Tiaro
Bruce	1938	4	Bay	H. H. Steinhardt, Tarzali
Captain Lustre	1908	4	Bay	J. T. Collett, Pomona
Carlyle Dobbin	1819	3	Bay	A. J. Paake, Wandoan
Chief	1820	3	Bay	L. S. Gordon, Broxburn
Dignity's Lad	1821	3	Bay or brown	J. H. L. von Pein and Sons, Quibet, Pittsworth
Douglas Credit	1899	4	Bay	W. G. Frey, Inglewood
Duke	1927	5	Bay roan	G. C. Seierup, Gracemere
Everton Duke	1822	3	Bay	A. C. Tuppack, Jimbour
Fairholme Eclipse	1850	4	Bay	A. and J. Sippel, Murgon
Fairval Noble	1879	4	Bay	H. M. H. Warneminde, Elizabeth street, Brisbane
Gaiety	1925	3	Bay	S. Titmarsh, Rawbelle
Gaiety's Favour	1880	4	Bay	W. F. Ehrich, Kulgun, Dugandan Line
Glenbrae	1900	4	Bay	J. O'Leary, Leyburn
Glengoon Hiawatha	1851	4	Brown	F. E. Mitchell, Byee
Glen Wallace	1852	4	Bay	S. B. Trigger, Biggenden
Heir's Like	1901	4	Bay	H. McMahon, Wheatvale
Irton Choice	1909	4	Bay	J. Drynan, Telemon Crossing
Kerrston's Joker	1881	4	Bay	H. M. Chaille, Esk
King	1853	3	Bay	W. R. Nichol, Biggenden
Kirkcaldy Flash Len	1823	4	Bay	A. Kahler, Geham
Kirkclady Journalist	1931	3	Roan	F. A. Lehmann, Lismore, Victoria
Kirkcaldy Preference	1882	3	Bay	W. Profke, Glamorgan Vale
Lion	1854	4	Bay	W. J. Patteson, Mundubbera
Lion	1939	4	Roan	W. R. Trembath, Paxton street, Townsville
Lochiel	1940	4	Bay	S. W. Smith, Ravenshoe
Lord Nelson	1824	4	Bay or brown	E. M. Schefe, Coalbank, *via* Wutul
Lustre's Perfection	1932	3	Brown	Mrs. A. R. Elliott, Laidley
Mailboy's Royal Prince	1855	3	Bay	Mrs. J. Lye, Monto
Major	1941	4	Bay	A. G. Spotswood, Box 231, Home Hill
Major Dawn	1933	4	Brown	F. A. Lehmann, Lismore, Victoria
Majuba Lord Nelson	1826	3	Bay	S. O. Mear, Carrington road, Toowoomba
Ngapuna's Pride	1883	3	Bay	P. J. Connole, Helidon
Noble King	1902	4	Bay	D. C. O'Leary, King's Creek
Oakdale Favourite	1825	4	Bay	E. C. Stark, Pinelands, Crow's Nest
Pinevale Darnley	1934	3	Bay	F. A. Lehmann, Lismore, Victoria
Premier's Pride	1827	3	Bay	A. Walker, Rockmount, Helidon
Pretty Robin	1828	3	Bay	R. Hamilton, Southbrook
Pride	1903	3	Bay	C. H. Kedwell, Post Office, Texas
Pride of Marcellus	1910	4	Black	W. and S. Welk, Nambour
Prince	1911	4	Bay	N. V. Burnett, Telemon
Prince	1922	3	Bay	H. Lott, Kensington, Bowen
Prospect	1904	4	Bay	R. E. Gillespie, Junabee, *via* Warwick
Ranger	1856	4	Bay	H. C. Taske, Bundaberg
Rare Gaiety	1884	4	Black	R. Harsant, Warril View, Harrisville
Rosebank Kerrston's Pride	1857	4	Bay	F. Benson, Gundiah
Rose Farm Regal Lustre	1885	4	Bay	R. Drew, Forest Hill
Royal Add	1829	3	Bay	W. T. Gillies, East Cooyar
Royal Dignity	1858	3	Bay	E. Reinbott, Kingaroy

Draught Stallions Certificated for the Year 1939-40—*continued.*

Name.	No.	Age.	Colour.	Owner.
Royal Duke	1859	4	Bay	A. H. Lowe, Kandanga
Royal Laddie	1886	3	Black	W. C. Heit, Obum Obum, Kalbar
Royal Lustre	1935	3	Bay	H. A. Stuhmcke, Glenore Grove
Royal Reserve	1887	4	Bay	J. Morrow, Peak Crossing
Scotland Yet	1920	3	Bay	A. Smith, Merinda
Sir Dale	1888	4	Bay	Mrs. I. M. Arndt, Rosewood
Sir Dignity	1832	3	Bay	P. Keane, Linthorpe
St. Helen's Major Dignity	1936	4	Bay	Forge Bros., Tamworth, New South Wales
St. Hilda's Nugget	1912	4	Bay	W. Drynan, Glenapp
Sudbourne Esq.	1942	3	Chestnut	P. Kidd, Malanda
Talgai Streamline	1943	3	Bay	J. Tate, Tolga
Tamar Kerr	1889	4	Bay	C. A. Gnech, Boonah
Terang Duke	1905	3	Bay	C. A. H. Head, Swanfels
The Iron Duke	1860	4	Bay	C. A. Kington, Monto
Top Boundary	1890	4	Bay	A. Wienholt, Kalbar
Trementheere Royal	1861	4	Bay	A. H. Tanzer, Abercorn
Valetta Horoscot	1921	4	Bay	A. H. W. Cunningham, Strathmore
Vamphire Heir	1891	3	Bay	F. H. Hahn, Coulson
Wee Willie	1830	4	Bay or brown	Barlow and Little, Wandoan
Wellcamp Sox	1831	4	Bay	P. Crotty, Wellcamp
Wheatley Lustre's Pride	1944	4	Brown	J. Favier and Sons, Kairi
Wigton's Pride	1906	4	Bay	W. V. Noble, Freestone
Wolsingham Imperialist	1926	4	Bay	T. Clark, Bororen
Young Douglas	1913	4	Bay	J. Martin, Tambourine

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REJECTED STALLIONS.

List of stallions in respect of which Certificates of Registration were refused on account of lack of type and/or conformation, lack of size or unsoundness during the year 1939-40. These horses are prohibited from service, either public or private.

Blood Stallions Rejected during the Year 1939-40.

Name.	Age.	Colour.	Reason for Rejection.	Owner.
Arabia	6	Grey	Unicrypt	C. Clark, A.M.P. Buildings, Brisbane
Blackboy	4	Black	L.T.	J. Peters, Nanango
Buoyant Son	5	Bay	Unicrypt	W. S. Smith, Brisbane
Calm Simon	3	Dark bay	L.T.	O. N. Winter, Kumbia
Eucalyptus	4	Brown	L.T.	W. Chapman, Gin Gin
Nigger	6	Black	L.T. and C.	D. J. Kildey, Cootharaba
Peter Pan	5	Bay	L.T.	T. J. Scott, Proston
Prince	Aged	Chestnut	L.T.	O. J. Hair, Watalgan
Rustic	4	Chestnut	L.T. and C.	H. G. A. Hickman, Bororen
Westcott	6	Bay	L.T.	T. Toomey, Boonenne

Pony Stallions Rejected during the Year 1939-40.

Grey Dawn	3	Iron grey	L.T.	Dick Neilson, Bundaberg
King Pin	5	Blue grey	L.T. and C.	Robertson and Co., Killarney Station
Mick	4	Brown	L.T.	C. Sharp, Biggenden
Shakespeare	4	Bay	Unicrypt	V. N. Bauer, Mount Sylvia

Draught Stallions Rejected during the Year 1939-40.

Allendale	3	Bay	L.T. and C.	E. Edwards, Tarzali
All John	4	Bay	L.T. and C.	Bergl Australia London Ltd., Pandanus Creek Station, Pandanus Creek
Ardlaw's Son	4	Bay	L.T. and C.	B. Hegarty, Back Plains, Clifton
Baldie	4	Brown	L.T. and C.	S. J. Haughtey, Box 90, Ingham
Barron Intent	6	Black	L.T. and C. and S.B.	E. G. Harte, Kaban
Bischof	4	Bay	L.T.	F. Sbresni, Watalgan
Black Prince	6	Brown	L.T. and C.	G. Ellrott and Sons, Sliepner Junction
Bowler	Aged	Bay	L.T. and C.	R. Campbell, Peeramon
Brown Carlita	6	Brown	L.T. and C.	F. M. Trembath, Charters Towers
Captain	5	Bay	L.S.	C. F. Wilkinson, Grantham
Clinker	5	Bay	L.T. and C.	J. Moran, Taragoola
Darcy	5	Bay	L.T.	Mary F. Tobin, Dallarnil
General Gordon	8	Brown	L.T. and C.	H. G. Walters, Proserpine
Havelock	6	Brown	L.S.	D. H. Butler, Miles

Draught Stallions Rejected during the Year 1939–40—*continued*.

Name.	Age.	Colour.	Reason for Rejection.	Owner.
Joker	7	Bay	L.T. and C.	T. J. Devine, Proserpine
Kingdale	7	Bay	S.B.	W. Eastwell, Willowvale
Larry	7	Brown	S.B.	A. H. and E. M. Kelland, Wowan
Lightfield Chief	4	Bay or brown	L.T.	J. A. Reibel, Gympie
Lord Eacham	6	Bay	L.T. and C.	J. G. Winfield, Yungaburra
Major	4	Black	L.T. and C.	W. H. F. Wordsworth, Manton
Major	7	Grey	L.T. and C.	H. Bawden, Reid River
Mast Gamble	4	Bay	L.T.	I. C. Bubke, Biggenden
Noble	5	Bay	S.B.	M. McMahon, Sladevale
Nugget	4	Blue roan	S.B.	R. Welch, Palen Creek
One	8	Chestnut	L.T. and C.	W. Kohn, Mareeba
Patch	6	Bay	L.T. and C.	T. Kersnovske, Ubobo
Patch	4	Bay	L.T. and C.	E. Sparksman, Mount Marshall
Pigeon's Pride	5	Bay	L.T. and C.	W. T. Brown, Calliope
Prince Royal	4	Bay	S.B.	M. E. Glasheen, Clifton
Royal Chief	6	Chestnut	Unicrypt	W. R. Lester, Gin Gin
Royal George	4	Bay	L.T. and C.	P. B. Nutting, Harrisville
Square William	5	Bay	Stringhalt	G. H. Rettke, Emu Vale
St. Helen's Ivo	5	Bay	S.B.	R. W. Matsen, Homebush
Tiger	5	Roan	L.T. and C.	W. R. Trembath, Paxton street, Townsville
Worthy Carlisle	9	Bay	S.B.	S. H. Andrew, Laidley
Unnamed	7	Bay	L.T. and C.	Bruce Bros., Taragoola
Unnamed	5	Steel grey	L.T. and C.	F. M. Trembath, Charters Towers
Unnamed	Aged	Chestnut	L.T. and C.	F. M. Trembath, Charters Towers
Unnamed	7	Black	L.T. and C.	F. M. Trembath, Charters Towers
Unnamed	4	Chestnut	L.T. and C.	E. Stern, Caboolture

HORSE BREEDING A NATIONAL DUTY.

Discussing probable wartime demands for good quality horses, a well-known horse breeder remarked recently that latterly there has been very little doing in the breeding of both light and heavy horses. Now that horses are sure to be required in large numbers—that is, if the war lasts very long—the question of guaranteed purchase is worth while considering as a stimulant to the industry. To every farmer with good stock the advice is offered not to miss the opportunity to breed as early as possible, whether for remounts, light cavalry horses, active or heavy draughts. To breed horses looks like a national duty these days, not only because horses are still wanted for military purposes, but because they are an essential part of our agricultural economy.

There may be no need to worry yet awhile over petrol and fuel oil supplies for cars and tractors, but the first call on these must be for the defence forces. Should our petrol supplies be seriously interrupted for any length of time, it is certain that farm production will be considerably lessened, and that would mean that there would be a restriction in our export trade at a time when we should be able to send every surplus bale, bag, or box of produce to the Old Country. With horse power we know where we are, with mechanical power we may never know where we stand against all sorts of outside influences.

In other countries—Britain, Canada, and the United States—schemes for the encouragement of horse breeding have been in working order for a number of years, in anticipation of just such an emergency which has been forced upon us. Even in New Zealand, a Remount Encouragement Act has been in operation for over a year now, and it has already proved its advantage to both breeders and the Dominion Government. Something of the kind is well worth consideration by all concerned in our own security.

Brisbane Milk Board.

THE Minister for Agriculture and Stock (Mr. F. W. Bulcock), referring recently to the operations of the Brisbane Milk Board, indicated that apart from other material benefits under *"The Milk Supply Act of* 1938," such as protected and improved markets, equity of supply, guaranteed payments, improvement in quality through specialized assistance in production, the economic position of producers generally has been improved considerably.

Since the inauguration of the provisional Board there have been only two variations in the price paid to producers for milk supplied. For the year 1938 the average price paid was 10·216d. per gallon, and for 1939 the average price was 10·716d. per gallon. This represents an advance in price of ½d. per gallon.

Since 1st January, 1939, producers paid a levy of ⅛d. per gallon on milk supplied under the board's jurisdiction, which leaves a net increase of ⅜d. per gallon on milk supplied during 1939, as compared with milk supplied in 1938, representing an additional net income to producers of approximately £6,450, and an average increase of nearly £15 per annum to each producer last year.

The following table shows the average price paid to producers since 1931:—

1931	8d. per gallon.
1932	8·333d. per gallon.
1933	8d. per gallon.
1934	7·875d. per gallon.
1935	8·5d. per gallon.
1936	9·6d. per gallon.
1937	10·2d. per gallon.
1938	10·216d. (Provisional Board).
1939	10·716d. (The Brisbane Milk Board.

For the seven years prior to the establishment of the provisional Milk Board, the average price to producers was 8·644d. per gallon, compared with an average price of 10·466d. per gallon for the years 1938 and 1939 during which the provisional Board and the Milk Board have been operating.

For the eight years 1931-1938, prior to the establishment of the board, the average price was 8·8d. per gallon, compared with an average of 10·7d. per gallon in 1939.

After allowing for the payment of ⅛d. per gallon levy, the net average price payable to producers since the passing of the Milk Supply Act is a little more than 1¾d. per gallon in excess of the average price paid to producers for the eight years prior to that date. This, in effect, stated the Minister, means that for the year 1939 milk producers received an additional net income of over £30,000 on milk supplied under the board's control as compared with the average price paid during the eight preceding years, and this represents on the average an additional income of approximately £65 pr annum to each producer.

The Acid or Base Forming Property of Fertilizers Sold in Queensland

By R. A. TAYLOR, A.A.C.I., Inspector and Examiner, Seeds, Fertilizers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch.

FOR some years it has been recognised that certain fertilizers increase the acidity of the soil to which they are applied. The accumulated effect of numerous additions of acid-forming fertilizer can bring the soil to such a condition that the growth of crops may be adversely affected.

A review of fertilizers in use over a large number of years in the United States of America shows that, whereas average fertilizers in 1900 were actually base-forming to the equivalent of 40 lb. calcium carbonate per ton (2,000 lb.), in 1932 they had become acid-forming to the equivalent of 150 lb. calcium carbonate[2]. The development of ammoniacal fertilizers (such as ammonium sulphate) is put down as the chief cause of this state of affairs.

One American authority,[5] speaking of the State of South Carolina, states that the use of acid-forming fertilizer materials on naturally acid soils has resulted in a large proportion of the soils becoming too acid for the successful production of even such acid-tolerant crops as cotton and tobacco.

He goes on to say that recently it was realised that soil acidity was one of the basic limiting factors in determining the productivity of the soil, and soil acidity determinations were made on over 2,000,000 soil samples—covering about 95 per cent. of all the farms in the State. A large proportion was found to be too acid to support a type of agriculture capable of maintaining an adequate standard of living.

In a review of American investigations on the subject, W. H. Pierre[1] states that the following conclusions with respect to the different types of fertilizers have been reached:—

1. *Nitrogenous fertilizers.*—Ammonium compounds tend to produce acidity, except in the presence of sufficient base-forming elements. Nitrate compounds of sodium (or calcium) have a basic effect on the soil.

2. *Phosphatic fertilizers.*—Dicalcic phosphate and tricalcic phosphate have a basic effect on the soil. Monocalcic phosphate has, in general, no residual effect.

3. *Potassic fertilizers.*—These, generally, have no residual effect on the soil.

Ammonium compounds tend to have an acid reaction because of the process of nitrification which takes place in the soil; the amount of nitrogen absorbed by the plant in the form of ammonia before nitrification is generally considered very small. Because of further absorption of nitrogen by the plant as nitrate, however, the theoretical residual acidity is considerably reduced.

With sodium nitrate, apparently the plant absorbs more nitrate than sodium—leaving a basic residue.

On actual field test, superphosphate, although theoretically acid-forming, is, practically, almost neutral.

Generally, it may be assumed that the effect of any fertilizer on the soil may be taken as represented by its acid-base balance—that is, the ratio of acid-forming elements to base-forming elements in the fertilizer. Only one-third of the phosphoric acid and only one-half of the nitrogen should be considered as acid-forming, however—as deduced from field tests.

The acid-forming and base-forming elements may be set out as follows:—

Acid-forming—	Base-forming—
Sulphur.	Calcium.
Chlorine.	Magnesium.
$\frac{1}{3}$ of Phosphorus.	Potassium.
$\frac{1}{2}$ of Nitrogen.	Sodium.

If the amounts of the elements present in the fertilizer are known, the equivalent acidity or basicity can be readily ascertained.

The following definitions may be taken as covering equivalent acidity or basicity as supplied to fertilizers:—

The equivalent acidity of a fertilizer is taken as the acidity produced in the soil by the fertilizer, measured in terms of calcium carbonate necessary for its neutralisation.

The equivalent basicity of a fertilizer is taken as the basicity produced in the soil by the fertilizer expressed as its equivalent of calcium carbonate.

These terms, as used in the United States of America, take calcium carbonate ($CaCO_3$) as the standard of measure; fertilizer labels in Queensland bear the percentage of lime (CaO), 56 per cent. CaO being equal to 100 per cent. $CaCO_3$.

In actual practice, a direct method—evolved by W. H. Pierre[1]—of estimating this acidity or basicity may be used.

This involves taking a known quantity of the fertilizer, and igniting to remove organic material—after adding sugar (to help ignition) and sodium carbonate (to retain sulphates, chlorides, and phosphates)—adding a fixed quantity of standard acid, and titrating the excess acid against a standard alkali. In the presence of nitrates, carbon black is added instead of sugar. A blank is run off, using sodium carbonate and acid as in the original test, and this also is titrated against the alkali. If more alkali is required with the original than with the blank, the fertilizer is acid-forming; if less is required with the original, the fertilizer is base-forming. Different ignition temperatures show little variation in results; a maximum temperature of 650 degrees C. is given as being apparently the optimum. This test does not include any acid formed by nitrogen, as this is lost during ignition.

Only one-third of the phosphoric acid is included. This is ensured by titrating with methyl red as an indicator—the first hydrogen of the phosphoric acid (H_3PO_4), only, being neutralised.

It must be realised that the American ton is 2,000 lb., whereas the British ton is 2,240 lb. Therefore, all figures relating to units of nitrogen, phosphoric acid, or potash, in American literature, should be corrected by multiplying by 1.12—e.g., a fertilizer containing 20 per cent. nitrogen in the United States of America would be used in the proportion of 100 lb. to the ton to obtain 1 unit (1 per cent. per ton) of nitrogen. In Queensland 112 lb. would be needed. The equivalent acidity per unit of nitrogen of a 21 per cent. nitrogen sulphate of ammonia is given in the United States of America as 107 lb. of 100 per cent. calcium carbonate. Approximately 120 lb. would be the equivalent per unit of nitrogen for 21 per cent. nitrogen sulphate of ammonia in Queensland.

The acidity due to nitrogen is calculated directly from the nitrogen present in the fertilizer. Nitrogen in the soil acts as nitrate, and its neutralisation may be represented thus:—

$$2N \longrightarrow 2HNO_3$$

$$2HNO_3 + CaCO_3 \longrightarrow Ca(NO_3)_2 + H_2O + CO_2 .$$

The acid-forming capacity of 2 parts of nitrogen (whether as nitrate or ammonium) is the equivalent of the base-forming capacity of 1 part of calcium carbonate.

The atomic weight of nitrogen and molecular weight of calcium carbonate are 14 and 100 respectively; therefore, as 2 parts of nitrogen equal 1 part of calcium carbonate, the equivalent values of nitrogen and calcium carbonate are 28 and 100—that is, the nitrogen percentage must be multiplied by $100/28 = 3{\cdot}57$.

As before mentioned, however, only ½ of the nitrogen (because of the absorption by the plant) is taken as producing an acid residue. Therefore, 1·785 is the factor by which the nitrogen percentage must be multiplied to obtain the equivalent of calcium carbonate.

For each unit of nitrogen (1 per cent. per ton), the factor would be $22{\cdot}4 \times 1{\cdot}785 = 39{\cdot}98$ (approximately 40). The United States of America factor for obtaining the equivalent of 1 unit of nitrogen is 35·7[1]; this, of course, is based on 2,000 lb. This value, as mentioned above, must be added to or subtracted from the value obtained by the actual analytical acidity test.

For instance, sulphate of ammonia containing 21 per cent. nitrogen is found to give an acid value on analysis equivalent to approximately 1,675 lb. of $CaCO_3$ per ton. The nitrogen acidity calculated is equivalent to 840 lb. (21×40) $CaCO_3$ per ton. The total *acidity* is, therefore, equivalent to 2,515 lb. $CaCO_3$—120 lb. per unit (2,515/21).

Nitrate of soda, 16 per cent. nitrogen, gives an analysis *basicity* equivalent to approximately 1,300 lb. $CaCO_3$ and calculated nitrogen acidity equivalent to 640 lb. (16×40) $CaCO_3$—the difference being a *basicity* of 660 lb. $CaCO_3$ per ton—41 lb. per unit (660/16).

United States of America figures give acidity 107 lb. and basicity 36 lb. respectively as corresponding figures—on a 2,000 lb. ton basis.

The accompanying table sets out equivalent acidity or basicity values for the common fertilizers used in Queensland.

The figures given are approximate, calculated from the net equivalents based on all constituents of the fertilizer—by titration of the non-nitrogenous residue, and adding or subtracting the nitrogen acidity.

Name of Fertilizer.	Analysis.	Equivalent in lb. $CaCO_3$.			
		Acidity.		Basicity.	
		Per Ton.	Per Unit.	Per Ton.	Per Unit.
Nitrogenous Fertilizers—					
Ammonium sulphate	21% Nitrogen (N)	*2,515	120	..	..
Sodium nitrate	16% Nitrogen (N)	..	..	660	41
Dried blood	13% Nitrogen (N)	500	39	..	..
Phosphatic Fertilizers—					
Superphosphate	20·5% Phosphoric Acid (P_2O_5) (Water sol.)	Neutral			
Rock phosphate	37·0% Phosphoric Acid (P_2O_5)	..	..	‡1,300	35
Potassic Fertilizers—					
Muriate of potash	50% Potash (K_2O)	Neutral			
Sulphate of potash	48% Potash (K_2O)	Neutral			
Nitrogenous-Phosphatic Fertilizers—		Ranges from			
Blood and bone ..	†6–10% Nitrogen .. 16–6% Phosphoric Acid	†340	..	270	..
Bonedust	†3% Nitrogen .. 23% Phosphoric Acid	..	..	†950	..

* These figures for sulphate of ammonia are converted from values obtained in the United States of America. Values obtained by the Agricultural Chemist on two samples of sulphate of ammonia offered for sale in Queensland, however, are given as 2,510 and 2,521 lb. $CaCO_3$ per ton, respectively.

† Meatworks fertilizers consist of varying proportions of animal protein and tri-calcic phosphate—ranging from dried blood to digested bonemeal. In this progression from a preponderance of "nitrogen" to a preponderance of "phosphoric acid" they alter from acid forming to base-forming—covering the ranges shown above, *i.e.*, dried blood, 500 lb. acidity; blood and bone, 340 lb. acidity to 270 lb. basicity; and bonedust 950 lb. basicity. Digested bonemeal may give up to 1,360 lb. basicity.

‡ Although rock phosphate is given a high basicity value by this method, actually—at normal degree of fineness—its rate of action in the soil is very slow compared with superphosphate.

In calculating the acidity of any mixed fertilizer, the percentages of nitrogen, phosphoric acid, and potash should be multiplied by the unit acidity or basicity given for the forms concerned, and addition or subtraction made where required.

With blood and bone, or bonedust, it is necessary to calculate approximately the amount of ingredient used and take that proportion of the equivalent per ton given in the table; no unit equivalent is given for these fertilizers, as they contain both nitrogen and phosphoric acid—which would necessitate a complex apportioning of values.

In the United States of America, steps have been taken to correct the soil acidity—chiefly by internal neutralisation of mixed fertilizers by incorporating dolomite, and by stating on the fertilizer label the equivalent acidity or basicity. Legislation is in force in certain States, requiring the latter to be carried out. The State of North Carolina, for instance, requires all official samples of fertilizers taken by inspectors to be analysed for acidity or basicity.[6]

The general use of lime (burnt or pulverised limestone) as a separate application to the soil is also advocated.

The reason for using dolomite in fertilizer mixtures, as against limestone, is that investigations[3] have proved that no reversion of monocalcic phosphate (as in superphosphate) occurs with dolomite; whereas some reversion can take place under certain conditions of temperature, moisture, and pressure, with limestone.

Two main reasons for the adoption of the method of "internal neutralisation" in the United States of America are given:—

One is that, because of lack of appreciation of the position, and failure to use lime as a routine practice, the soils in certain areas have apparently become so acid that a neutral or basic fertilizer is absolutely necessary; with respect to this, it is stated that the six South-eastern States of the United States of America—where acidity trouble is experienced—use more than 50 per cent. of the fertilizer and less than 5 per cent. of the lime used in the United States of America.[5] The other reason is that a large proportion of the fertilizers used in the United States of America contain filler—mostly sand—and the incorporation of dolomite in place of such filler is a logical step.

In Queensland, however, a stage such as is mentioned in the first reason, has not been reached; also, filler is not used in fertilizer mixtures in Queensland.

If the farmer uses lime fairly liberally as a routine practice, an acid-reacting fertilizer may be used regularly without ill-effect.[4]

Consequently, although the danger arising from excessive application of acid-forming fertilizers should be fully appreciated, there does not appear to be justification in Queensland for adoption of the steps taken in the United States of America—routine liming of soils admittedly being an efficient means of prevention.

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[3] MACINTIRE, ET AL.: (Ind. and Eng. Chem. Vol. 24, pp. 933-941, 1932).
[4] MORGAN, M. F.: (American Fertilizer, Jan., 1938, p. 24).
[5] COOPER, DR. H. P.: (American Fertilizer, July 22, 1939, p. 7).
[6] REPORT OF AMERICAN CHEMICAL SOCIETY: (American Fertilizer, 16 Sept., 1939, p. 8).

VALUE OF FORESTRY IN WAR TIME ECONOMY.

Britain's forests are one of her lines of defence. Science workers now know the secret of extracting sugar from the softwoods of the English countryside, such as birch, ash, elm, and sycamore. Clothing material, motor fuel, dyes, many essential chemicals, various cattle foods, transparent paper, and even sausage skins are among other things yielded by trees.

If all other supplies of these commodities were cut off, Britain could "live on her forests" for at least six months, and very likely a year. Apart from private plantations, hundreds of thousands of acres of trees have been planted by the Forestry Commission since the war of 1914-1918.

"We can now produce many of the vital necessities of life from wood," stated the chief chemist of the Forest Products Research Laboratory recently. He goes on to say:—"There is no waste, for science has made every part of a tree valuable for something. So-called waste wood has been used for a year by one of our own research workers as fuel for his motor car. Using it in a special and inexpensive generator, he gets speed of over fifty miles an hour and covers great distances at the cost of a few pence. A substitute for glass, used chiefly for aeroplane windows, is yet another product of the woods and forests of the British Isles."

HOW TO SHOOT A HORSE.

Unfortunately, it becomes necessary sometimes to destroy a horse. Shooting is probably the most humane method, and this is how it is done:—

Theoretically, the best path for the bullet is one going through the brain and along the spinal column, but in practice that is rather difficult to achieve. The practice of shooting in the centre of the forehead between the eyes is one that has caused needless pain to many a wretched animal, as the bullet usually passes into the throat without touching the vital centres. If two lines are imagined running from the top of the eyes to the base of the opposite ears, as shown in the diagram, and the point where they intersect is taken as the target, a shot aimed more or less parallel with the ground will pass through the brain and sever, even if it does not follow, the spinal cord. If the animal's head is lowered as when feeding at an ordinary manger, the bullet will probably traverse the spinal column for some distance, although a bullet through the brain will in most cases cause instantaneous death.

A revolver is the best type of firearm to use, with the exception of the specially-designed "humane-killers," but a rifle or shotgun may be used. The muzzle of the weapon should be almost touching the skin of the animal's forehead when the shot is fired.

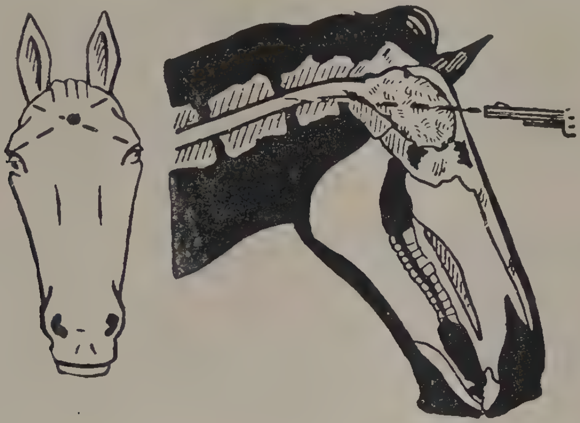


Plate 80.

Shooting Pigs.

When killing a fairly large pig, shooting the animal will avoid the hideous squeals which usually make this task even more than usually unpleasant. Where the sole armament is a low-powered pea-rifle, it frequently happens that the bullet fails to penetrate the skull when fired into the centre of the forehead. The pig has a fairly thick ridge of bone running down the centre of the head, and for this reason it is advisable to shoot diagonally from a position a short distance above but nearer to the centre of the skull than the eye.

Much suffering is caused by people who are not intentionally cruel simply through ignorance of the structure of an animal's skull, and it is hoped that these few notes will enable readers to kill their animals with a minimum of pain and suffering.

A SWISH OF A TAIL—AND A TALE OF A SWISH.

An unusual accident happened on a farm recently. At threshing time a horse standing near the thresher switched his tail at a fly. The tail was caught in the thresher and torn off. So badly was the machine damaged—to say nothing of the damage to the unlucky horse—that threshing had to be postponed for repairs. The fly escaped.

General Notes

Staff Changes and Appointments.

By an Order in Council under "*The Dairy Products Stabilisation Acts,* 1933 *to* 1936," Mr. H. S. Hunter, Director of Marketing, has been appointed to be a member of the Dairy Products Stabilisation Board. The approval of the Executive Council also has been given to Mr. Hunter's appointment as a member of the Committee of Direction of Fruit Marketing.

Messrs. St. G. Thorn (Bacteriologist) and J. A. Rudd (Government Veterinary Surgeon) have been appointed members of the Veterinary Medicines Board until the 22nd January, 1942. The other board members are the Agricultural Chemist and the Chief Inspector of Stock.

Mr. E. T. Lewin, inspector under *The Stock, Slaughtering, and Dairy Produce Acts,* has been transferred from Dalby to Brisbane.

Mr. D. Aiken, Bundaberg Cane Disease Control Board, has been appointed an honorary inspector under *The Sugar Experiment Stations Acts.*

Sergeant A. F. Kahler, Boulia, has been appointed also an inspector under *The Brands Acts.*

Messrs. F. F. Bishop, Don River, Bowen, B. M. Hannan, Conway Station, via Collinsville, and J. B. Henderson, Collinsville, have been appointed honorary protectors under *The Fauna Protection Act.*

Mr. G. P. Lambert, New Farm, a scoutmaster of the Boy Scouts' Association, has been appointed an honorary protector and honorary ranger, respectively, under *The Fauna Protection Act and the Native Plants Protection Act.*

Cane Prices Board.

Under *The Regulation of Sugar Cane Prices Acts,* the following persons have been appointed, as representatives of the owner or owners of the mills and as representatives of the canegowers, to be members of the respective local sugar cane prices boards:—

Bingera—
Millowners' representatives—B. A. Bourke and R. T. N. Smith.
Canegrowers' representatives—J. F. Cromarty and L. G. Scotney.
Chairman—C. D. O'Brien.

Cattle Creek—
Millowners' representatives—P. H. McLean and G. W. Shaw.
Canegrowers' representatives—Jas. Turner and J. M. Pratt.
Chairman—H. L. Kingston.

Farleigh—
Millowners' representatives—E. Evans and John Smith.
Canegrowers' representatives—A. Fordyce and J. R. Malcolmson.
Chairman—C. B. Buxton.

Goondi—
Millowners' representatives—J. Ross Kerr and D. A. Williams.
Canegrowers' representatives—H. Klarwein and R. J. Wright.
Chairman—C. Burchill.

Hambledon—
Millowners' representatives—R. T. Easterby and E. W. Segaert.
Canegrowers' representatives—W. W. Chapman and W. D. Ishmael.
Chairman—A. Anderson.

Invicta—
Millowners' representatives—H. B. Burstall and J. L. Mullins.
Canegrowers' representatives—H. F. Hecht and W. E. G. Smith.
Chairman—T. E. Dwyer.

Isis—
Millowners' representatives—A. Adie and J. Alison.
Canegrowers' representatives—B. Foley and W. M. Duncan.
Chairman—E. H. Baker.

Kalamia—
Millowners' representatives—J. W. Gray and J. W. Inverarity.
Canegrowers' representatives—J. Breen and M. A. Coyne.
Chairman—T. E. Dwyer.

Macknade—
Millowners' representatives—N. S. Beatty and N. R. Dowling.
Canegrowers' representatives—G. Cantamessa and K. Livingston.
Chairman—A. E. George.

Marian—
Millowners' representatives—A. J. Coyne and R. J. Leck.
Canegrowers' representatives—G. Ollett and E. C. Walz.
Chairman—C. B. Buxton.

Mourilyan—
Millowners' representatives—G. R. Blair and H. G. Selby.
Canegrowers' representatives—G. F. Hudson and B. B. Ross.
Chairman—C. Burchill.

North Eton—
Millowners' representatives—B. F. Hogan and N. F. Lever.
Canegrowers' representatives—S. F. Lowther and A. Smoothy.
Chairman—H. L. Kingston.

Pioneer—
Millowners' representatives—G. R. Ashwell and B. C. J. Martin.
Canegrowers' representatives—B. S. Donovan and L. W. J. Hoey.
Chairman—T. E. Dwyer.

Plane Creek—
Millowners' representatives—A. Innes and S. H. Scougall.
Canegrowers' representatives—C. W. Davidson and J. Lawrie.
Chairman—C. B. Buxton.

Rocky Point—
Millowners' representatives—W. H. Heck and F. W. Heck.
Canegrowers' representatives—B. A. Ernst and H. W. Koppen.
Chairman—J. J. Leahy.

South Johnstone—
Millowners' representatives—A. J. McRobbie and C. E. Myers.
Canegrowers' representatives—A. H. Reichardt and W. J. Henderson.
Chairman—C. Burchill.

Victoria—
Millowners' representatives—N. R. Dowling and M. Mackellar.
Canegrowers' representatives—E. L. Burke and G. G. Venables.
Chairman—A. E. George.

Wild Life Preservation—Toowoomba.

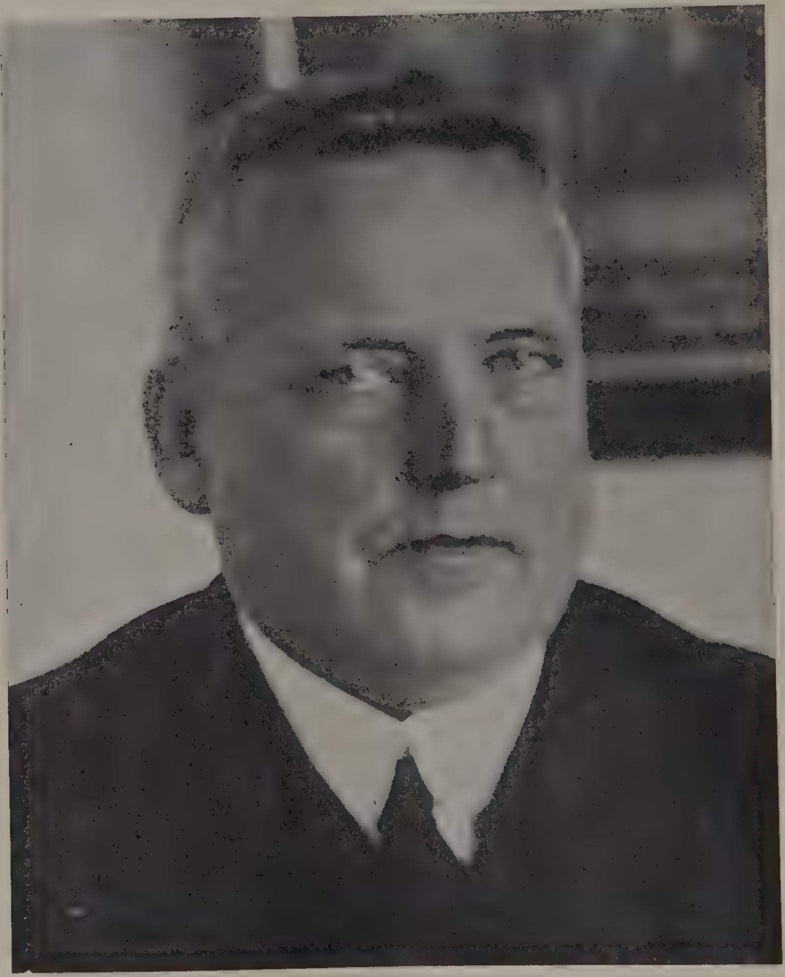
An Order in Council has been issued under "*The Fauna Protection Act of* 1937," declaring the residential district of the city of Toowoomba to be a sanctuary under the Act.

Size of Apples.

An amendment of regulations under *The Fruit and Vegetables Acts* raises the present minimum size of apples intended for sale from 2 inches to 2¼ inches. The amendment sets out the size requirements for the different varieties of apples.

In Memoriam.

LIEUTENANT-COLONEL A. H. CORY, V.D., M.R.C.V.S.



[From an official group photograph, Department of Agriculture and Stock.]

Plate 81.

THE LATE LIEUT.-COLONEL A. H. CORY.

THE passing of Lieutenant-Colonel Arthur H. Cory, who died at his home, Wynnum, on 18th December, after a very brief illness, is recorded with deep regret.

The late Colonel Cory, who had been Chief Inspector of Stock for nearly twenty-five years, retired from the Public Service in November. He had completed arrangements for commencing private practice as a veterinary surgeon in Toowoomba.

He was born sixty-five years ago in Devonshire, England, where his family had been landholders for many generations. After graduating from the Royal College of Veterinary Surgeons, London, he practised his profession in different centres in the West Country. In 1901, he came to Queensland, and soon after his arrival obtained an appointment as veterinary inspector of stock in the Department of Agriculture and Stock. After a brief sojourn in England, he re-entered the service of the Department in 1908, and in the following year was appointed lecturer in veterinary science at the Queensland Agricultural College. In 1915 he was appointed Chief Inspector of Stock in succession to the late P. R. Gordon. As a veterinarian, he was intensely practical, with a gift for ready and accurate diagnosis of stock diseases. Among the recognised leaders of his profession, his name became a household word throughout rural Queensland.

At a large gathering of his fellow officers and representatives of the pastoral and agricultural interests only a few weeks before his death, high tributes were paid to the valuable services he had rendered to the Government and the land industries of Queensland in the course of his long and successful career.

The late Colonel Cory will be held in affectionate remembrance by all who had the privilege of association with him, either officially or socially. To those who knew him intimately, his chief hobby seemed to be doing good turns to his fellow man. A winning and genial personality, he had the gift of friendship, and was, above all things, a fine Englishman, in whom had grown an intense love of Australia and Australian ways.

In a fine tribute to his memory, the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) said: "The State has lost a distinguished veterinary officer, but his work will endure in the Department in which he had served so long and so ably."

To his bereaved family, profound sympathy is extended.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. C. T. White, Government Botanist.

"Bamboo Grass."

G.A.W. (Meandarra)—

The specimen is bamboo grass (*Stipa ramosissima*), a very common grass in Southern Queensland. It is frequent on cleared brigalow country, but more especially on cleared, mixed, rather dry scrub. It is not generally regarded as having much value as a fodder, although stock will eat it, especially when other grass is short.

Star Thistle—A Serious Pest.

S.C. (Crow's Nest)—

The specimen is star thistle (*Centaurea Calcitrapa*), a native of southern and western Europe. This plant, because of its very rigid, long spines, is a very serious pest. It has not previously been recorded for Queensland, but is fairly common on the New England Tableland of New South Wales, where it is regarded as a very serious pest. Naturally, it is imperative that a plant of this character should be eradicated immediately.

Hemlock—"Carrot Fern" or "Parsley Fern."

M.M.G. (Southport)—

The specimen is hemlock, *Conium maculatum*, commonly grown as an ornamental plant under the name of ''carrot fern'' or ''parsley fern.'' The plant is a well-known poisonous one, and recently we received a record of its having poisoned a child in Queensland. This is the first record of its kind so far as we know in this State, although it has been accused of causing deaths in England and America.

Yellow Oleander.

J.E.H. (Rathdowney)—

The specimen is *Thevetia neriifolia*, sometimes called the Yellow Oleander. It makes a handsome shrub and is fairly drought resistant. It belongs to a poisonous family of plants, and we have always regarded it as poisonous. We have, however, heard at times of people eating the fruit without any ill-effects.

Cape or Balloon Cotton.

J.R. (Yeerongpilly)—

The specimen is Cape Cotton or Balloon Cotton, *Gomphocarpus fruticosus*, a native of South Africa, with a wide distribution as a weed in Australia. The plant belongs to a poisonous family, the Asclepiadaceae, and has several times been suspected of poisoning stock. Feeding tests at Yeerongpilly have proved the toxicity of the plant.

Horehound.

J.McG. (Coominya)—

The weed forwarded is the Horehound, *Marrubium vulgare*. The leaves and tops of this plant are used in making up cough mixtures. The plant also is used in the manufacture of herbal beer.

There is a small market for the leaves here, and if you are interested you may get in touch with Taylors and Elliotts Limited, Charlotte street, Brisbane.

There are no particular methods of eradication, and if the land can be put under cultivation the weed generally disappears. Arsenical sprays would be effective, but have the disadvantage of rendering the plant poisonous. Although stock do not eat it under normal conditions, they sometimes have a partiality for these arsenically sprayed weeds. Sodium chlorate in weak solutions is not poisonous to stock, and you could try this or some of the commercial weedkillers in which it is used as a basis.

Yellow Pea.

M. (Tara)—

The specimen is *Cassia Sophera,* commonly known as yellow pea. The name arsenic bush is sometimes applied to this and other allied species of cassia. Feeding tests with them, however, have given negative results. They belong to the same genus as the plants which produce the senna leaves of commerce, and if eaten in any quantity by stock have a purgative effect.

Germination of Wattle Seeds.

Project Club, Boonarga—

Sometimes wattle seeds can be germinated by simply sowing in flats or seed beds in the ordinary way, in rather sandy soil, but usually special treatment is advisable. The easiest method is to place the seeds in a cup and pour boiling water over them, leaving them to soak for some hours. A New South Wales nurseryman, who specialises in the collection and sale of Australian native tree seeds, has the following to say about them.—"In sowing the seed of the Acacias my method is to plant them in seed beds. After getting the ground prepared, pull the soil back from where you are going to sow the seed, then after sprinkling the seed in, cover the soil about 1 inch over the seed and bat it down with the back of a spade or roller lightly and pour boiling water all over the seed bed, and throw some bags on top to keep the steam in until it cools off. This is the best method that I know for bringing the seed up quickly. You would have to keep the ground damp until they come up. This may be two or three weeks before they show. Acacia seed is one of the hardest to germinate, owing to its hardness; but the boiling water softens them and does not hurt the germ. It may be important to know that most of the Acacia seeds will keep ten years and then germinate well. When the little plants are about 3 or 4 inches high they could be transplanted out, about 10 to 12 feet apart, on a suitable damp day, and if no rain, keep watered about once a day for two weeks, or even longer, according to the weather." Regarding transplanting under Queensland conditions, it is sometimes advisable to put the young plants out into pots or tins, and later transplant to permanent positions.

Josephinia Burr.

O.L.H., Rockhampton—

The plant has been identified as *Josephinia Eugeniae,* the Josephinia Burr. This is a native burr plant which is fairly common in the western parts of the State. The burr, when plentiful, becomes entangled in the wool and thus reduces the price of the wool.

Medick Burr.

R.W.B., Hughenden—

The specimen is the Medick Burr (*Medicago denticulata*). This is an annual leguminous plant which is a native of the temperate parts of Europe and Asia. It is very common on the Darling Downs. It is also frequently found as a weed in lawns during the winter months of the year. It is an annual and has a good reputation as a winter fodder plant, being comparable in food value to White Clover.

Knot Grass. Summer Grass.

G.M.L., Boyland—

The weed is Knot Grass, *Polygonum aviculare,* a very common weed in cultivation in Australia, and widely spread over the temperate regions of the world. It is not known to possess any poisonous or harmful properties, but it has been reported on occasions that the long, wiry stems have caused impaction in stock.

The grass is Summer Grass (*Digitaria adscendens*), a very common grass in Queensland, mostly occurring as a weed of cultivation. When it occurs in ordinary pastures, it favours rather light sandy soils. It is generally regarded as quite good fodder for stock.

Climbing Buckwheat.

S.L., Ramsay—

The specimen is the Climbing Buckwheat (*Polygonum Convolvulus*). This plant is not particularly abundant in Queensland, but has the possibilities, when introduced into a locality of becoming a bad pest in cultivation. Its eradication is therefore recommended.

Rural Topics

Grass and Water.

The water question always looms large, and, no doubt, the time will come when every stock route will have a water supply at the end of every daily stage, though, at the moment, that sounds like a drover's dream. Still it must come as the result of a growing "water consciousness" among the powers that be. Dr. Bradfield has set many people thinking on the feasibility of his proposal for diverting ever-running coastal streams in that region in North Queensland where the yearly rainfall is measured with a 3-foot rule, to the dry interior where the rivers rarely become anything else than a chain of waterholes. The recent Macrossan Lectures, of which water conservation was the theme were certainly of topical interest; likewise a public discussion on Queensland's natural water storage system, which was instituted by Dr. Whitehouse, of the University of Queensland. Amongst other things, he spoke of the peculiar way in which the West is watered. Fed by monsoonal rains—when they do occur—the Western rivers and channels fill and spread out in seas of fresh water 30 to 40 miles wide; the waterholes are scoured and kept clean and the grass grows high like wheat on the Downs after a good October storm. It's a fine picture, but actually that doesn't happen every year; but when it does happen there are no half measures about it.

The Western artesian water system is no less fascinating, and the fact that bore flows have diminished to a large extent in recent years is causing a lot of worry, but Australia is not alone in this experience, as the same thing is happening in the United States and other countries. It is interesting to theorize about it, but the water problem generally will have to be faced. An enormous population is supported by irrigation and water conservation in India, and there seems no reason why our own water supply projects should not be extended. In the higher rainfall districts of the State—especially in the coastal country—shortage of water should never happen, even in the driest season. Whether Dr. Bradfield's dream is realizable or not, these public discussions have done an immense amount of good, and more people are thinking water—as well as drinking water—as a result, and this increased interest must lead eventually to comprehensive schemes for conserving water and intelligently using the enormous volume which runs to waste every year. After all, we all subsist on grass and water which is meat and drink to everyone of us.

Pigs Being Divorced from Cows.

In Canada, pig feeding is drifting further away from the dairy cow. Nor is this trend limited to specific districts, according to a director of an experiment farm in the Dominion. This is what he says:—

> This change has required pig feeders to substitute other forms of protein and other nutrients formerly obtained from milk.
>
> To-day, the purebred pig incapable of making desirable bacon economically has no place on a farm. The purebred must have a direct commercial application. A third factor is that in some districts there are a lot of by-products from quick-growing crops that can be converted into marketable products by feeding them to livestock. Cull potatoes and other more or less waste stuff can be fed to pigs.
>
> At this Canadian experiment farm they are seeing how much corn can be used and still obtain A grade pig carcases. Other crops like cull beans also are being used, but beans have to be cooked to obtain the best results. Tests with corn show that to produce the right type of pigs, no more than 30 per cent. of corn can be fed until the pigs weigh 100 lb. After that from 50 to 60 per cent, of corn may be fed.

That is very interesting, but it is safe to say that it will be a long time before pig raising is divorced from dairying in Queensland.

Why Eggs are Small.

Here's a story with a farm flavour that is going the rounds: The young housewife complained to the grocer that the eggs were very small. He assured her that the eggs were "straight from the farm this morning." "There," she replied, "that's the trouble with these farmers. They're so anxious to get their eggs sold that they take them off the nests too soon!"

The Farmer in War Time Britain.

Unlike the position in 1914, the British farmer is well prepared for any emergency with a measure of efficiency which is reassuring to all concerned. Everything is now in train to direct the production and distribution of food. Prices have been fixed from the outset. No loophole has been left for profiteering on farm produce, and strict rationing of essential commodities will secure a fair deal for everyone.

So far as farming is concerned, no full-scale measures will be put into operation until after the present harvest which is approaching completion. The reserve of farm tractors will then be brought into service for ploughing every available arable acre. Very complete plans have been prepared for central and local organizations to increase the production of food and feedingstuffs. The Ministry of Agriculture is responsible for the central direction, and executive committees have been set up in each county to whom important functions will be delegated. These committees have already appointed sub-committees, one for each of these sections of the farming industry: cultivation; farm labour supply; machinery supply and use; livestock and fodders; general farming supplies; drainage; pest and disease control; and land utilization.

Each county has been divided into convenient districts, and each district sub-committee will serve as the eyes and ears of the executive committee.

Control of prices of food and feeding stuffs will be exercised by the Food Controller. Commodities are bought on the farm at fixed prices, which will be adjusted as circumstances require. From this point, the Food Controller takes charge. A Ministry of Food has been organized and its aim is to provide every consumer with a regular and fair share of essential foodstuffs. Planning has been done in close collaboration with trades and labour councils.

Large reserves of foodstuffs have been stored and these are being distributed on a rationed scale.

The Ministry of Food buys all overseas foodstuffs and is looking after their importation; it also buys all home-produced supplies, and aims to eliminate all competition and speculation. Prices of all important foodstuffs sold to the public have been fixed.

As approximately half of Britain's food requirements are imported—mostly from the Dominions—the Queensland producer of export commodities has a very special interest in the war-time food policy of the Old Country, and any measure which will prevent profiteering—the Queensland farmer doesn't ask for more than a fair price, and certainly has no desire to profit from any distress which may arise in the motherland—will be welcomed by all concerned in seeing the Empire safely through the present international crisis.

Beware of Gas in the Silo.

It is always necessary to be very cautious before enclosing a silo which has just been filled with fresh silage. Under certain conditions carbon dioxide, and other gases more or less equally deadly, are given off by the green stuff during the process of fermentation.

This is what the British Ministry of Agriculture advises:—

(1) The crop should have reached the proper stage of maturity and should not be too dry. With an immature crop the extent and nature of the fermentation that will take place is uncertain. An abnormal volume of carbon dioxide, or possibly other gases, may be generated. If the material is very dry it will not tread down closely, the additional air so retained causing the evolution of a larger volume of carbon dioxide than usual.

(2) The material should be well trodden down before work is done for the night.

(3) No door should be sealed up unless it is absolutely certain that the material will not sink below the level of the bottom of the door.

(4) Before work is resumed, the lower door should be opened. No one should be allowed to enter the silo until a reasonable time has elapsed.

(5) When the silo is being filled by an elevator, as long an interval as possible should be allowed to elapse after the lowest door has been opened, to allow any harmful gases to escape.

Money in Mud.

A farmer in New Zealand has been experimenting with tidal river mud as a top dressing for pastures. As reported in *The New Zealand Farmer Weekly,* this is what he says:—

"There is a mint of wealth lying waste in our tidal river mud, and few ever give it a thought. It is the best fertilizer we have, and I believe that if our paddocks could be top dressed with it, it would help to solve the problem of a lot of sickness amongst our stock. Only the weight of it and the bother of getting it out is against it.

"I have a large mound in one of my paddocks caused by the uprooting of some trees ages ago. The grass would never grow on it, although it got its share of the top dressing that went on the paddock every year. About ten years ago, I sledged mud out of the river and left the wet, sticky mass on the bare mound in shovelfuls. It set as hard as cement through the summer months, and I thought it was useless and that I had all my work for nothing. But in the autumn, when the rains came, it all crumbled down like fine flour. I raked it all over the mound. It could not have been more than an eighth of an inch thick, but the good grass soon grew on it, and it is as good to-day and as green as any other part of the paddock. And all due to the mud."

A Handy Maize Weeder.

From Gisborne, New Zealand, comes the report of a handy maize weeder invented by a local farmer.

The implement comprises a double row of long spring steel teeth which taper gradually to a point. These teeth scratch along the two rows of maize with a chattering action and weed the crop in a most efficient way. It is designed to handle the weeding of maize from the two-leaf stage until the crop is about 1 foot high. The depth of penetration of the teeth can be altered to suit varying conditions by adjustible wheels. The draught is light, one horse easily pulling the machine, and one man can efficiently deal with an acre on hour.

—*New Zealand Farmer.*

Great Britain's Three-Year Food Plan.

Consolidation continues on the home food front in Great Britain. County war committees have got well into their stride. Certain agricultural produce has been exempted from war insurance risks.

The great job of preparing on a three-year basis for feeding the nation has got into swing so smoothly and rapidly that it speaks volumes for the effectiveness of pre-war planning.

Government action has been taken to safeguard both the farmer and the consumer. The dual aim is to safeguard the primary producer against sharp rises in costs of production and to make available a sufficient supply of food over the counter and butcher's block at reasonable prices.

In cereal production all limits have been removed. Cattle, sheep and pig prices are fixed, and a fair average price has been placed on milk.

Things to-day are very different in the Old Country for the farmer than they were in 1914. Food and feeding stuffs, fuel and other requisites are stored. Over 60,000 tractors are in private hands—that is, on the farms—and there is a large reserve stock for release as required. Great Britain has entered on the conflict in a far better position for ploughing up the country than it was at the end of 1918.

Grooming the Milking Cow.

Grooming of dairy cattle is a refinement in farm management which calls for comment. High-producing animals are usually kept on high-priced farms, where natural scratching or rubbing-posts—trees or stumps— have been removed. Frequent milking and stall feeding prevent during much of the day the natural function of self-licking. Both these small inhibitions have a marked effect on milk production, and it has been observed that, under these conditions, some grooming is decidedly beneficial.

Treatment of Cream.

Dairy farmers are again advised to give close attention to the cooling, aerating, and stirring of cream. The flush growth of grass in the wet season often causes a gassiness in cream, as well as a "feedy" flavour. Aeration and cooling will do much to offset the development of these defects.

Prolific Berkshires.

Mr. W. J. Kajewski, of Glencoe, in a letter to Mr. T. Jones, Superintendent of the Farm Home for Boys, Westbrook, writes:—

"I desire to send you a report of two Berkshire sows I purchased from you in 1930. They both came in on their first litter in January, 1931, and each sow produced two litters a year, ranging from no fewer than ten pigs or more than fourteen pigs in each litter, and rearing on an average of over eleven pigs in each liter. One sow, up to date, has had eighteen litters, and is at present rearing thirteen out of the fourteen pigs, at the age of nine and a-half years. During her lifetime she reared 203 pigs, which were marketed as baconers.

The other sow had seventeen litters and, showing age, I thought she had had her day. She has produced and reared over eleven pigs on an average, and during her lifetime 195 pigs were sent to the bacon factory as her progeny.

You will notice both were good mothers, rearing the number they did."

War and the Farmer.

Probably the thought has come to the minds of many of us that the outbreak of war has automatically ended our marketing problems, particularly the familiar problem of what we have to do with our exportable surplus. It is just possible, too, that the idea that the war will be a "good thing," financially, has taken root in the minds of some of our farmers. Apart from the fact that producers are not so very keen on profiting unduly from the awful business of war, it is just as well not to be over-optimistic about export prices. Memories of what occurred twenty-five years ago when the Great War started—when prices of wool, butter, and other commodities were allowed to soar to the limits of demand—should not lead us to the belief that similar conditions will be experienced during this, possibly, greater war. There can be no reasonable expectation that anything more than the "fair price" level will be permitted. It is probable—if we may judge from official views already expressed—that the whole of the British Commonwealth will be under price control. At the same time, it is practically certain that prices will be profitable—that is, reasonably profitable—to the producers, and that every ounce of butter and cheese and every pound of wool and meat will be needed. Elaborate plans for maintaining Britain's food requirements during the war period have been made, and supplies from the Dominions will, of course—or, at least, it is reasonably supposed—be governed by those plans. It may be taken for granted that profiteering will not be allowed in any form—especially by the speculator in foodstuffs.

Maintenance of sea transport is, naturally, of vital importance, but farmers and everyone else concerned may rest assured that nothing has been left undone to prevent any dislocation of the export of our primary products.

Consequently, productive enterprise should not be checked in the slightest degree. The successful issue of this war will depend largely on the primary producers in the Dominions as well as in the Old Country, and farmers may get on with the job of producing to the limit of their holdings with the assurance that their efforts will be suitably acknowledged and rewarded. No one can say how long the struggle will last, but it is clearly the job of the producer, as for every other unit in the community, to keep on keeping on.

A Relieving Farmer.

A professional man always arranges for another to relieve him when he wants to take a holiday. If it is good for, say, a doctor to have a locum tenens, it also should be good for a farmer.

So what appears to be an unusual offer was made to a district executive of the New Zealand Farmers' Union, when a well-known local farmer said that he was willing to act as a relieving farmer to allow other farmers to go on holiday. He said his wife's services also were available. There's a practical idea in that proposal.

White-striped Cows in a Blackout.

Here's a news item from England:—Ponies in the New Forest are not the only animals to suffer the indignity of having stripes painted on them. Black-coated cows on English farms have been painted with white stripes so as to be visible to motorists if they stray on to the roads at night during the black-out.

Weather Wisdom.

It is undoubtedly true that certain animals can foretell rain when man cannot. For example, the aborigines have a saying that it will rain when the porcupines take to the hills. Even the city-dweller has several reliable rain signs; firstly, the domestic cat, which invariably seeks some sheltered spot in the house or under a shed when the sky looks threatening.

Then, of course, one may find one or more "huntsmen" spiders, or triantelopes, as they are sometimes called (they often measure as much as 6 inches across the span of the outstretched legs) on the wall of a room. . . .

Birds are fairly reliable rain guides. When, for instance, the domestic fowl starts to preen its feathers, rain is imminent. Also, seagulls fly towards the land and keep up a chorus of deafening cries when a storm is approaching.

By the same token, frogs will always croak at the first sign of a downpour. Apropos of which there is the story of an outback publican, who, in order to increase trade in times of drought, caught some frogs and put them in a tin under the bar. He then filled a can with water, and occasionally poured some over the frogs slyly, which caused an outbreak of joyous croaking. At this stage he would fill a glass with beer, and remark: "Well, gents, the frogs are croaking, so let's drink to the breaking of the drought."

This procedure always had the desired effect upon sales.

—*R.B.M., in "The Sydney Morning Herald."*

Doing Without a Horse Collar.

A new type of collarless harness now being sold in the United States makes it possible for a horse to pull with its body rather than with its shoulders. Side pads distribute the load evenly to the back, barrel, chest, breast, and neck. This gives free movement to the horse's legs and shoulders, and does away with the risk of shoulder sores.

Weed Killing—Three Golden Rules.

Weeds reduce the productive capacity of farms to a much greater extent than many farmers realize. Some farmers and graziers make a practice of carrying a light hoe with them whenever they have occasion to cross a paddock, and it is surprising the number of weeds they remove in the course of a year, almost without conscious effort. Here are three golden rules which it would pay every man on the land to observe:

1. Examine all crop seed for impurities before sowing. If impurities are found, send a sample to the Department of Agriculture, with a request for advice on them.
2. Keep a look out for any strange plant which makes its appearance on the farm. The Department will give information as to whether any such plants are weeds or otherwise.
3. All strange plants which are either known weeds or likely to become weeds should be destroyed before their seeds ripen and drop to the soil.

Unless these elementary precautions are taken, the time, labour, and money spent on destroying the plants are wasted, as a fresh crop of weeds, larger than before, will appear in the following season.

—*From "The New Zealand Farmer."*

Ploughing up Britain.

British farmers have now got 70,000 tractors ready to plough over a million and a-half acres of grass land for crops to maintain Britain's food supply.

In 1914, not one British farmer in a hundred had even seen a tractor. To-day, British tractors show a vast improvement in design over the few thousand which were put on the land in 1917. As they are much lighter, they can everywhere replace the horse; and with pneumatic tyres in place of the old steel wheels, not only are their upkeep and fuel consumption both lower, but they can now be used for road haulage work.

In many districts of Great Britain the methods of application of machinery are to-day second to none in the world, and this wider experience, coupled with the huge contingent of tractors now available, assures the fighting forces of the Old Country of more than adequate support on the home front.

The British Farmer and the War.

In his cropping and breeding plans, the British farmer is preparing for a three years war.

It is already very obvious that in this war the expansion of home agricultural production is going to be a matter of tremendous importance to the British farmer as well as to every household in the Old Country. Every farmer seems to be out to do his level best to make greatest contribution he possibly can to that end in the knowledge that he will be doing his bit to bring the war to a successful conclusion.

Every branch of primary industry has been organized on a war-time basis in accordance with plans previously prepared for the purpose. These plans were worked out in the light of the lessons of the last war of 1914-1918, and of the general economic position at home and abroad. The National Farmers' Union is working in complete co-operation with the British Government in the application of these war-time plans.

The British farmer, in his essential service of food production, is animated with the idea that the advantage of farming is that the effect of effort is cumulative. The better he does this season, the better he shall be prepared for the next; and it will take many years before there could be any automatic check from nature.

Farmers in the Old Country are in a better position now than they were in the last war for making the necessary effort, and the principle of bringing prices into relation with the cost of production—and this point has a very special interest for Queensland farmers—has now been accepted. At present, returns are regulated on the basis of the normal costs of production of crops now being marketed or already grown, but it is pretty certain that the British farmer has not heard the last of price-fixing.

Prices must, of necessity, follow costs, and they must follow costs after the emergency passes, especially for whatever time is necessary for returning to what is to be the normal. Further, effort in producing food can never be wasted, as it may be in the case of some war-time necessities.

Increased production means, of course, increased expense and the British farmer has not been slow in emphasizing that fact in his dealings with the authorities, but, no doubt, this is a matter which will be adjusted on a fair economic basis.

A Word for the "Waler."

An Austrian farmer, now working on a property just below the border in New South Wales, remarked the other day that since coming to Australia he had been greatly surprised to find how little interest was taken in horse breeding. He had heard so much about the "waler" as a military horse during the last war that he had expected to see great numbers of them in the country districts, but had been disappointed.

Despite the mechanization of armies in Europe, he said, the horse is still of great military value, and can be used over country where tanks and tractors could not. The war in Spain confirmed his belief, for there it was found that an army could not be kept constantly mobile, especially in bad weather, without horses.

Many horses may be wanted in the near future, and if there are any difficulties about petrol, wheatgrowers and other farmers would find it impossible to get on without them.

In any case, what horses were in Palestine during the last war they would be in a much greater degree in Australia in the event of our having to fight on our soil against any aggressor.

A Wonderful Wheat Yield.

Here is the record of a wheat yield—the sort of yield a farmer pictures in his mind when he gets a cheque from the Wheat Board:

A yield of 112 bushels of wheat an acre from a field of 7½ acres reported from Southland, New Zealand, has been confirmed by the New Zealand Wheat Research Institute. The institute considered the reported yield so remarkable that inquiries were made and confirmation was received from the field superintendent of the New Zealand Department of Agriculture, both of the measurements of the field and the total yield. The variety was Cross 7. It was not, however, purely an accident that it was Cross 7, because it is doubtful whether any other wheat grown in New Zealand would have stood up so as to allow of the harvesting of the great weight of grain it produced.

Effectiveness of the Electric Fence.

Two farmers installed an electric fence, and ran their pigs in the enclosed paddock. When the grass and herbage were eaten down the farmers decided to remove the pigs and took down the fence. But the pigs refused to budge beyond the limit of the former temporary paddock. Finally the pigs had to be lifted bodily and trucked a hundred yards or so to the new paddock. There they rooted around peacefully, confined by their new ''mental hazard.''

A example, surely, of the effect of matter over mind! There is no doubt about the effectiveness of the electric fence.

Something Like a Tractor "Speedo."

Savings in operating costs are reported by American users of a new instrument which records the engine revolutions of trucks or tractors. On the dial are two red pointers, set to indicate the revolutions per minute range within which the engine will operate at greatest efficiency. The gauge also records the total revolutions which show the ''invisible'' miles run when the engine is idling, when gears are being shifted, and so on.

Back to the Horse in England.

Interesting sidelights of the effect of war-time petrol restrictions in England are given in these two news items:—

The first report says that at a farm sale an ordinary sulky was sold for £26 10s. Until the outbreak of the war many of these vehicles, in good condition, were put aside as scrap. Now they are worth real money, as petrol is rationed.

The second item is that only two horses, the lowest number on record, were offered under the hammer at a horse sale. Farmers, evidently, are finding that horses are too useful to sell.

That Top Layer of Soil.

Erosion is probably the most important single factor causing loss of soil fertility. A large percentage of the available plant food in soil is present in the weathered surface layer, and may be permanently lost through the removal of that layer by erosion. A familar example may be observed in the loss of productivity caused by the formation of gullies. The loss which results from the gradual, uniform removal of surface soil by sheet erosion may be less apparent than by gullying, but it is no less real.

Egg Storage in Oil.

A new oil treatment to keep cold storage eggs in good condition for a period of at least six months has been announced by the Research Bureau of the United States Department of Agriculture.

Casein for Aeroplanes.

Because casein is used in the building of military aeroplanes, it has become scarce and trebled in price since last year, when casein was hard to sell at any price. All the casein made by one dairy company in New Zealand is to be sent to Canada to be used in aeroplane manufacture.

The development of the Canadian scheme for the making of aircraft for war purposes has been primarily the reason for the raising of the price received by the company to between £55 and £60 at the present time.

Pride in the Pasture.

This is from the New Zealand *Journal of Agriculture*:—

''A really good pasture is a continuous source of pride, as well as of profit to its owner. It is seldom the result of chance or good luck, but it is rather the reward of a period of consistent good management, during which expediency, or the prospect of immediate gain, has been subordinated to the ultimate objective of establishing a perfect grazing area.

"Bolshevisation" of Bees.

Russian science workers are trying to induce bees to work on plants they ordinarily dislike. On 230 farms on which their methods were applied, it is claimed that the pollination of various plants was increased tenfold. The yield of lucerne, which is usually not popular with bees, is said to have been trebled.

A "Spot" for the Lambing Ewe.

Whisky and milk has long been recognized as a suitable stimulant for the lambing ewe. However, the prohibition forces are now at work, and strong tea is being recommended instead of spirits—from half a pint of strong tea being given two or three times a day, or even oftener, if thought necessary.

Tea is regarded as a valuable restorative for ewes after lambing and one that is easily prepared. In parts of the South Island of New Zealand, if a lambing ewe continues to be in pain a little chlorodyne is added to the tea, although the chlorodyne should not be given more than three times daily.

A New Point in Fertilizing Practice.

It is a practice in parts of New Zealand to scatter superphosphate through hay and ensilage material when harvesting is under way. According to American experiments, it now appears that the use of super in hay, but more especially in ensilage making, has a very definite effect in increasing the phosphate value of the manure from animals fed with super-fortified feed. So encouraging have been the results of experiments along these lines that it is deemed possible that the regular spreading of such manure may yet become the cheapest form of phosphatic fertilization of the soil.

Giant Star Grass for Soil Erosion.

Giant Star grass, which is receiving attention as a controller of soil erosion in South Africa, is already under observation in New South Wales.

Star grass is a common name of all the couch grass varieties and species in East Africa. Trials in Kenya indicate that it is best suited to the lower, moist regions of that colony. It has shown, however, considerable drought resistance in Africa.

Great care is necessary in introducing new species to Australia, for some grasses develop prussic acid at certain stages of growth. Giant Star will, therefore, have to be put through the same tests as every other introduced plant before there can be any thought of making it available to farmers.

When Mr. Bulcock (Minister for Agriculture and Stock) was in the Argentine and Brazil recently, he arranged for the sending of some grasses new to Australia, and which are likely to be valuable additions to our pastures. These, of course, will have to be submitted to similar exhaustive tests.

Practical Patriotism.

Here is very commendable instance of practical patriotism:—The residents of Amiens in the Stanthorpe district have decided to take community action for the care of orchards if their owners, owners' sons or employees enlist in the defence forces. A committee of six residents has been formed to obtain the names of fruitgrowers enlisting or in camp, and of sons of orchardists who otherwise would be assisting their parents on the orchard. The idea is to see that orchards and properties are not allowed to be neglected during their absence on military service. This committee will ascertain whether arrangements have been made for the adequate care of the orchard, and, if not, it will do everything necessary to ensure that the property will be looked after. If local residents cannot do the whole task, they will ask the Deciduous Group Committee of the Committee of Direction of Fruit Marketing to co-operate with them in this very worthy and self-imposed work. The harvesting of fruit crops will be considered when the time for gathering them arrives.

This is just another instance of how the real Australian spirit is applied.

Arsenate of Lead—Its Danger on the Farm.

Like so many other poisons, arsenate of lead should be handled and used with the utmost care. It is dangerous to livestock. Experience has proved that, but the proof offered by one American farmer is much out of the ordinary. He had twenty-eight Jersey heifers in a paddock bordered by elm trees. The trees were sprayed with a mixture of arsenate of lead. Four days after the spraying there was heavy rain, and, presumably, the downpour washed some of the spray off the trees on to the grass beneath. All the heifers were affected, as indicated by temperatures and the functioning of internal organs. After two days of constant effort by veterinarians, all but twelve of the heifers were in fairly good shape. Seven of the twelve died later. Paralysis of the digestive and breathing organs and blindness preceded the deaths.

Farm Notes

MARCH.

LAND on which it is intended to plant winter cereals should be in a forward stage of preparation. Sowings of lucerne may be made at the latter end of the month on land which is free from weed growth and has been previously well prepared.

The March-April planting season has much in its favour, not the least of which is that weeds will not make such vigorous growth during the succeeding few months, and, as a consequence, the young lucerne plants will have an excellent opportunity of becoming well established.

Seed wheat should be treated with copper carbonate for the control of bunt. For oats and barley seed the use of formalin or a reliable mercury dust is advisable.

Potato crops should be showing above ground, and should be well cultivated to keep the surface soil in good condition; also to destroy any weed growth.

In districts where the potato crop is subject to Irish blight it is advisable to spray the plants for the control of this disease. Bordeaux mixture of 4.4.40 strength should be applied at least three times at intervals of ten days to a fortnight, commencing when the plants are about six weeks old.

Maize crops which have fully ripened should be picked as soon as possible and the ears stored in well-ventilated corn cribs, or barns. Selected grain which is intended for future seed supplies should be well fumigated for thirty-six hours and subsequently aerated and stored in airtight containers. The germination of the maize is not normally affected by this treatment if dry and mature when treated.

The following crops for pig feed may be sown:—Mangel, sugar beet, turnips and swedes, rape, field cabbage, and carrots. Owing to the small nature of the seeds, the land should be worked up to a fine tilth before planting, and should contain ample moisture in the surface soil to ensure a good germination. Particular attention should be paid to all weed growth during the early stages of growth of the young plants.

As regular supplies of succulent fodder are essentials of success in dairying operations, consideration should be given to a definite cropping system throughout the autumn and winter, and to the preparation and manuring of the land well in advance of the periods allotted for the successive sowings of seed.

The early-planted cotton crops should be now ready for picking. This should not be done while there is any moisture on the bolls, either from showers or dew. Picked cotton showing any trace of dampness should be exposed to the sun for a few hours on tarpaulins, bags, or hessian sheets before storage in bulk or bagging or baling for ginning. Sowings of prairie grass and *Phalaris tuberosa* (Toowoomba canary grass) may be made this month. Both are excellent winter grasses. Prairie grass does particularly well on scrub soil.

Dairymen who have maize crops which show no promise of returning satisfactory yields of grain would be well advised to convert these into silage to be used for winter feed. This, especially when fed in conjunction with lucerne or cowpea, is a valuable fodder. Where crops of Sudan grass, sorghum, white panicum, Japanese millet, and liberty millet have reached a suitable stage for converting into silage, it will be found that this method of conserving them has much to recommend it. If permanent storage facilities are not available on the farm the stack method offers a practical alternative. Stacking with a framework of poles, and well weighting the fodder, are necessary for best results. All stacks should be protected from rain by topping off with a good covering of bush hay built to a full eave and held in position by means of weighted wires.

Orchard Notes

MARCH.

THE COASTAL DISTRICTS.

If the weather is favourable, all orchards, plantations, and vineyards should be cleaned up, and the ground brought into a good state of tilth so as to enable it to retain the necessary moisture for the proper development of trees or plants. As the wet season is frequently followed by dry autumn weather, this attention is important.

Banana plantations must be kept free from weeds, and suckering must be rigorously carried out. There is no greater cause of injury to a banana plantation than neglect to cultivate. Good, strong suckers will give good bunches of good fruit. Weedy, overcrowded suckers will only give small bunches of undersized fruit hard to sell, even at a low price.

Cooler weather may tend to improve the carrying qualities of the fruit, but care should still be taken to see that it is not allowed to become over-developed before it is packed; otherwise it may arrive at its destination in an over-ripe and consequently unsaleable condition. The greatest care should be taken in grading and packing fruit. Small or inferior fruit should never be packed with good, large fruit.

There has been a marked increase in the banana thrips population in some districts in which this pest is well established. Growers who consider it necessary to deal with banana thrips are advised to apply to the Department for the latest information on how to deal with this pest.

The marketing of the main crop of pineapples, both for canning and the fresh fruit trade, will be completed in the course of the month, and, as soon as the fruit is disposed of, plantations, which are apt to become somewhat dirty during the gathering of the crop, must be cleaned up. All weeds must be destroyed, and if blady grass has got hold anywhere it must be eradicated, even though a number of pineapple plants have to be sacrificed, for once a plantation becomes infested with this weed it takes possession and soon kills the crop. In addition to destroying all weed growth, the land should be surface-worked and brought into a state of nice tilth.

In the Central and Northern districts, early varieties of the main crop of citrus fruits will ripen towards the end of the month. They will not be fully coloured, but they can be marketed as soon as they have developed sufficient sugar to be palatable; they should not be gathered whilst still sour and green.

As blue mould is likely to cause heavy loss in coastal citrus, especially in long-distance consignments, special precautions should be taken for minimizing this loss.

It must be remembered that the blue mould fungus will only attack bruised or wounded fruit; hence it is necessary to be careful that no injuries are given by the clippers or finger nails during picking. Fruit should be cut and not pulled. Long stalks which may injure other fruit must be cut away.

The fruit must be carefully handled and accurately packed so as to avoid bruising. Any injured fruit should be discarded. In order to reduce the number of fungus spores present in the plantation, all waste fruit in the orchard or packing shed should be collected at frequent intervals and destroyed by fire or burying.

Fruit must be carefully graded for size and colour, and only one size of fruit of one quality should be packed in one case. The standard bushel case, the inside measurements of which are 18 by 11½ by 10½ inches, is the best for citrus. The fruit must be sweated for seven days before it is sent to the Southern markets, in order to determine what fruit has been attacked by fruit fly, and also to enable bruised or injured fruit liable to blue mould to be removed prior to despatch.

Growers are reminded that the control of the bronze orange bug is best achieved by spraying with the resin-caustic soda-fish oil mixture normally either late in March or early in April. Applied at this time of the year, the spray can give a mortality of 98 per cent. of the bronze bugs, which are then present solely in the very young stages. This spray is also very effective against several of the important scale insects infesting citrus.

Red scale is a pest to which citrus-growers will shortly have to give attention, it being considered that control is best established from the middle of March to early in April. Fumigation with hydrocyanic acid gas is most effective against red scale, but success may also be achieved with white oils or with the resin-caustic soda-fish oil mixture evolved for the control of the bronze orange bug. Red scale, of course, is pre-eminently a pest of the hotter, drier citrus districts.

Strawberry planting may be continued during the month, and the advice given in last month's notes still holds good. Remember that no crop gives a better return for extra care and attention in the preparation of the land and for generous manuring than the strawberry.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

THE advice given in these notes for the last few months regarding the handling, grading, and packing of fruit should still be followed carefully. The later varieties of apples and other fruits are much better keepers than earlier-ripening sorts, and as they can be sent to comparatively distant markets, the necessity for very careful grading and packing is, if anything, greater than it is in the case of fruit sent to nearby markets for immediate consumption. Instruction in the most up-to-date methods of grading and packing fruit has been published by the Department, which advice and instruction should enable growers to market their produce in a much more attractive form.

The same care is necessary in the packing of grapes. Those who are not expert cannot do better than follow the methods of the most successful packers.

As soon as the crop of fruit has been disposed of, the orchard should be cleaned up, and the land worked. If this is done, many of the fruit-fly pupæ that are in the soil will be exposed to destruction in large numbers by birds, or by ants and other insects. If the ground is not worked and is covered with weed growth, there is little chance of the pupæ being destroyed.

Where citrus trees show signs of the want of water, they should be given an irrigation during the month, but if the fruit is well developed and approaching the ripening stage, it is not advisable to do more than keep the ground in a thorough state of tilth, unless the trees are suffering badly, as too much moisture is apt to produce a large, puffy fruit of poor quality and a bad shipper. A light watering is therefore all that is necessary in this case, especially if the orchard has been given the attention recommended in these notes from month to month.

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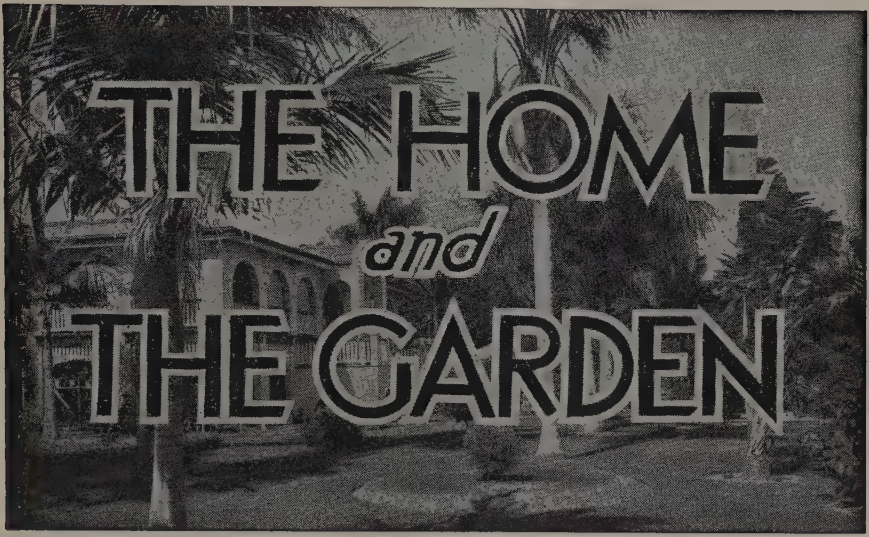
FRUIT JUICES AS SUMMER DRINKS.

In fruit marketing the Californian fruitgrowers have attained very high standards for both fresh and processed fruits. Now they are going one better by developing the fruit juice industry, and this recent development suggests a way out of our own problem of over-production which most fruitgrowers have to face at one period or another in every year.

In a warm climate, people should be induced to drink their fruit as well as eat it.

There has been an extraordinary increase in the quantity of fruit juice consumed in America, and this has had a remarkable influence on the food habits of the whole nation. Great strides have been made in nutrition research, and commerce has been quick to adapt itself to the new food technique. In all these changes the fruitgrower has come definitely into the picture. Primary products have hitherto found their markets without science or system, although they are just as adaptable to modern merchandising methods as those of the manufacturer.

The primary producers, obviously, should keep on organizing themselves and their industry, especially on the marketing side. Rigid standardization of high-grade products, duly branded and guaranteed, and widely advertised, is the chief requirement. With summer upon us, it would be an excellent plan to concentrate on advertising our wonderfully nutritious fruit juices—natural juices, not synthetic substitutes.



Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

THE VALUE OF SLEEP AND REST IN CHILDHOOD.

ACCOMMODATION AND COT.

Without restful sleep, and plenty of it, a child does not grow as he should, although he may be correctly fed, properly clothed, and in other respects well cared for. The best part of growth takes place while a child is asleep. Sleeping should be the main occupation of a child during the early months of his life. Hunger interrupts the sleep of a normal healthy baby, and the feeling of satisfaction and comfort which should follow the taking of a meal induces sleep. It must be mentioned, however, that, if a baby during the first few days of life, when he is usually very sleepy, does not wake for his food and is allowed to sleep undisturbed, at the end of this time he may be unwilling to suck the breast. There is no more difficult child to manage than one who has not been trained to suck properly. Much of the time of the child welfare nurse is occupied in overcoming the results of this form of mismanagement.

As a child grows older he sleeps less, but up to the time he is twelve months old he should have at least two hours' sleep in the morning and a sleep in the afternoon, in addition to the twelve hours' sleep at night, which is broken by one feeding for the first nine months. Insufficient sleep will cause a child to be irritable and fretful and will interfere with his normal development. Up to the time he goes to school he should continue to have his morning sleep or morning rest period. The value of this is recognised by many mothers as well as by nursery school and kindergarten directors.

Sleeping Accommodation.

The room in which the child sleeps should be well ventilated. A suitable veranda provides excellent sleeping accommodation, particularly during the day and also at night, if it has been made weatherproof.

Cot.

Baby should have his own cot which should be placed so that he is protected from strong winds and the direct rays of the sun. Do not use a swinging cot, but a fixed one with wire gauze sides which can be let down. Make sure that there are no spaces in the sides or between the mattress and the frame into which part of the child's body might pass.

Mattress.

The foundation mattress should be firm, well studded, and fairly thick. A shakedown containing light oaten chaff should be placed on the mattress. The purpose of this is to provide a soft, cool nest for baby, which can be readily renewed if it becomes soiled. The chaff should be carefully picked over to remove any prickly pieces and baked in a tin before being used. This may be done very satisfactorily by putting the chaff into half a kerosene tin and keeping it in a moderately heated oven for about one hour. It is advisable to stir the chaff periodically while it is being baked. The case of the shakedown is usually made of unbleached calico and this should be half filled with chaff.

If it is necessary to use a hot water bag or bottle on account of the cold weather or because the child is poorly nourished, this can be placed conveniently and safely between the mattress and the shakedown.

Bed Clothing.

During the warmer weather very little bed clothing is required. It should be light and placed loosely over the child and tucked in at the sides of the cot. A sleeping bag is useful on certain occasions. It is well to bear in mind that the temperature tends to fall in the early hours of the morning. During cold weather the cot may be made warm and comfortable by placing across it a blanket large enough for its edges to come well over both sides and the foot of the cot. The mattress and shakedown are placed on top of the blanket and upon the shakedown a piece of blanket is laid. This is covered with a sheet which is tucked in well all round. Across the centre of this is placed a piece of waterproof sheeting which is covered with a strip of flannelette long enough to be used as a draw sheet. Upon this is placed the baby who is clad in an easily fitting gown and covered loosely by a large, light shawl made of radianta, cashmere, or Kremlaine, depending upon the season of the year. Finally each side of the large blanket is lifted over and tucked in on the opposite side of the cot and the piece at the foot is brought up and pinned.

Pillow.

Actually baby does not need a pillow at all, but a small thin one does no harm and helps to make him comfortable. Large soft pillows are unhealthy because they tend to interfere with his breathing. A baby has been known to suffocate by burying his face in a large soft pillow.

Light oaten chaff makes an excellent filling for a pillow, and as in the case of the mattress this should be carefully picked over, baked, and enclosed in a cover of unbleached calico. Care should be taken to avoid having lace or embroidery where the baby's head will lie.

Baby's Position.

Mothers used to say that a baby should not be allowed to sleep on his back because the back of his head would become flattened. Others said that he should not be allowed to sleep on his stomach because he might smother. Baby may be safely placed on his back or on his side, providing the mother has carried out the directions already given in regard to making his cot. It is usual to change baby's position from time to time. As he becomes older he will change his position as he pleases.

In placing baby in the cot it is advisable to keep his head about six inches away from the top. In the case of an older child a small flat pillow may be attached to the top by means of tapes in order to prevent him from rubbing his head on the wire.

Mosquito Net.

A sound mosquito net should be placed on the cot and made secure under the mattress to protect the child from flies and mosquitoes. Care should be taken to prevent the net coming into contact with the child's body. If a mosquito-proof cot can be secured, the net, of course, will be unnecessary.

Spare No Trouble.

When it is remembered how much time baby spends in his cot, it will be realized that no trouble should be spared to make it as comfortable as possible.

Indifference to Ordinary Sounds.

A healthy child should be able to sleep undisturbed by the sounds associated with the ordinary activities of the household.

Information on all matters concerning infant and child welfare may be obtained from the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred street, Fortitude Valley, N. 1, Brisbane.

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COCKROACH CONTROL.

Cockroaches are nocturnal, hiding during the day in dark corner and crevices, where they congregate in large numbers. In the house, they usually hide near the sink and drainboard, behind the kitchen cabinet, and in similar places. If disturbed when foraging at night, they run rapidly for shelter, and a knowledge of where they conceal themselves is usually the key to their control.

In Queensland, houses are constantly being reinfested by adults crawling and flying in from outside, and no control measures can keep a building continuously free from the pest, if reinfestation is possible. Therefore, it is first necessary to clean up all outbuildings and burn accumulated rubbish of any kind. All cockroaches found hiding in packages of food and merchandise being brought into the house should be destroyed. They may be killed mechanically or by spraying with a proprietary fly spray. Crack fillers, such as putty or plaster of paris, can be used effectively to close many openings used by cockroaches as avenues of escape to hiding places. This is particularly important if cockroaches are coming in from adjacent apartments, through wall spaces or along the plumbing fittings.

Sodium fluoride is the best cockroach remedy for use in homes which have already become infested. If the power is not readily available in pure form, suitable commercial preparations, generally known as insect powders, containing up to 80 per cent. sodium fluoride, can be obtained from any grocer. Sodium fluoride is poisonous to man if taken internally in sufficient amounts, and it should be kept out of food and away from children and pets. If used with reasonable care in cockroach control, however, no harm will follow. It may be sprinkled by hand along the back of shelving, draining boards, and other places frequented by the pests. When so placed in the runways the powder adheres to the limbs and is subsequently taken in through the mouth as the insect cleans itself. Sodium fluoride therefore acts as a stomach poison. The powder remain effective indefinitely in dry situations, but in very damp places it may cake and become useless.

Sodium fluoride is best applied with a small duster or bellows and blown into the hiding places. In this way more cockroaches are directly affected, for they die rapidly when the powder is blown directly on them. The application should be made in the evening and the powder left for two or three days. Frequent treatments are usually necessary at intervals of one or two weeks if the pest is to be kept under control.

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GARDENING FOR GRACE.

Gardening is the best form of exercise for the woman of forty odd. It will also help her to retain a graceful figure.

The suppleness of youth has a disconcerting habit of disappearing with increasing years ,and it is absolutely essential for the "not so young" to take some sort of outdoor exercise.

There are women, well past middle-age, who still play a strenuous game of tennis, or indulge in other energetic forms of sport, but for the average woman of forty odd, medical opinion is that a less vigorous form of exercise is desirable, and for this gardening is ideal. The muscles are kept supple, there is no chance of joints getting stiff, and that bugbear—the "middle-aged spread"—is kept well at bay!

Walking about inspecting one's handiwork, bending, stooping, squatting, exercising different muscles with each movement is definitely slenderizing, and there will be little likelihood of that "spare tyre" round the middle making its appearance!

It is unnecessary to acquire that weather-beaten look usually associated with the woman who spends her time in the open air indifferent to wind or sun. A shady hat will protect skin or eyes, a scarf, one's neck. No woman coverts a supple figure at the expense of a reddened complexion, or network of fine wrinkles round the eyes caused by insufficient protection from the dazzling sun.

Plate 82.

YOUNG AUSTRALIA.—On the lawn at ''Bostocks,'' Mr. R. Bligh's home, near Brookstead, Darling Downs.

Plate 83.

THE MORNING SUN CASTS DEEP SHADOWS ACROSS THE LAWN.—A corner of the garden at Condamine Plains, Mr. A. C. V. Bligh's station home, Darling Downs.

Gardening gloves can be worn to protect the hands, but they are rather cumbersome. Scratch your nails on the soap before you garden, it will prevent them from becoming filled with earth. Never wash your hands in hot water if they are very dirty, it will only open the pores of skin and the earth will become ingrained. Wash them in cold water until quite clean, if necessary remove any stains with pumice stone, then rub well with cucumber or hand lotion.

It is hard work—gardening—you will want to pause for breath; when you do, do a little deep breathing. Few people really fill their lungs to capacity when they breathe normally, now is your opportunity to do so. Take deep breaths of the pure air, it will exercise your chest muscles, and invigorate your blood with life-giving oxygen.

There is nothing more steadying for the nerves than an hour or two in the garden—alone. Household cares and worries are forgotten, or if too urgent to be entirely put aside, at any rate can be regarded with a certain detachment and often seen in better perspective. There is time to *think*, but try and let your thoughts dwell on happy, peaceful things, give your mind a rest, just for a spell, and wrinkles of worry and anxiety a chance to disappear.

For the woman of forty odd, who cannot indulge in strenuous exercise, but who wishes to keep her muscles supple, and her figure youthful and full of grace, there is no exercise that will accomplish this as perfectly as gardening.

—C. I. M. Courtney in "South African Gardening," Spring Number, September-November, 1939.

IN THE FARM KITCHEN.

SUMMER SALADS.

THE food value of salads cannot be over-estimated, especially those served with oil dressings. The oil furnishes heat, while uncooked fresh vegetables and many fruits also used in salads contain many valuable mineral salts which contain essential elements.

Care and judgment should be used in selecting the combinations that make up the salad, and which should be chilled, crisp, attractive, and simple.

Choose a large bowl to mix a green salad; place a clove of garlic in a crust of bread, rub the bowl well with it, then remove the garlic and allow the bread to remain in the bowl during the mixing. When ready to serve, remove bread.

Tomato Cups.

Scald six medium tomatoes and remoke skin. Place in ice chest to chill. Peel and cut a long young cucumber into very thin slices, add 1 cup finely shredded celery (best part), 1 finely chopped apple, ½ cup chopped walnuts, 1 tablespoon red or green pepper, finely shredded. Moisten with a cream salad dressing, and fill tomatoes. To scoop out centre of tomatoes, use a vegetable scoop; it is much easier than using a spoon. Arrange tomatoes in crisp lettuce leaves; sprinkle over them a few very finely chopped chives or finely chopped parsley. Serve very cold.

Ham and Vegetable Salad.

Mix together 1 cup lean diced ham, ½ cup cooked beans cut into dice (not shredded), ½ cup diced cooked carrot, beetroot, haricot beans, peas, and diced potatoes. Add ½ cup French dressing, and allow to stand for one hour. When ready to serve, place on crisp lettuce cups, put a dab of mayonnaise on top, sprinkle with a little finely chopped parsley, and serve.

Lobster Salad.

Remove meat from lobster and chop into small squares. Sprinkle over it a little French dressing and chill thoroughly. When ready to serve, mix with enough mayonnaise to moisten, place in lettuce cups and garnish with curled celery, grated raw carrot, and small peeled and well-chilled tomatoes. Rub any lobster coral through a sieve and sprinkle over top of lobster.

Rice and Prawn Salad.

Combine 2 cups well-cooked unpolished rice (cold), 2 tablespoons very finely minced onion, 2 cups chopped prawns, 2 teaspoons chopped capers, 4 chopped olives, 4 sour gherkins, and 1 tablespoon cold cooked bacon, chopped finely. To 1 cup French dressing add 1 teaspoon chopped parsley, 2 tablespoons chili sauce; mix well together, then place a layer of broken lettuce, a layer of rice, &c., and so on, till the bowl is full. Separate 2 hard-boiled eggs, put through a sieve, and sprinkle over top.

Mayonnaise.

Place 2 egg yolks in a basin, add pepper and salt to taste, and 1 teaspoon lemon juice. Now add ¼ cup olive oil drop by drop, stirring well all the time. These first few drops are the most important. Now whisk with an egg whisk as it is much quicker, adding 2 tablespoons oil at a time until used up. Mix ½ teaspoon mustard with 2 tablespoons vinegar, and add to oil mixture. Do not keep oil mayonnaise in ice chest, as it would cause oil to separate and come to top. If this should happen, place 1 egg yolk in another basin and gradually add oil mixture.

French Dressing.

Place ¼ cup vinegar in a bottle, add salt and pepper to taste, ¼ teaspoon mustard (optional), 1 teaspoon sugar, and a little paprika. Now add ¾ cup best olive oil and shake well together. A sliced clove of garlic may be added, but should be removed before serving. Place dressing in ice chest, and when ready to serve, shake well.

Boiled Salad Dressing No. 1.

Melt 1 tablespoon butter in double saucepan, add 1 tablespoon flour, salt and pepper to taste, 1 teaspoon made mustard, and a little paprika. Add the yolks of 3 eggs beaten with 1 tablespoon water, add ¼ cup vinegar, and stir until thick. Allow to cool, then add ½ cup cream or milk.

Boiled Dressing No. 2.

Heat ¼ cup best olive oil in saucepan with ½ cup vinegar, and 2 tablespoons water. When hot, add 4 well-beaten eggs gradually, stir well, and add salt, pepper, paprika, and 2 teaspoons made mustard. Cook until mixture thickens. Place in jar and seal. When ready to serve, thin with cream or milk.

Cabbage Combination Salad.

Shred very finely 1 small solid head cabbage, soak until crisp in ice-cold water; drain and dry well. Finely chop 1 large onion, 1 red or green pepper, 1 grated carrot, ½ cup chopped celery, and, if liked, 3 or 4 radishes, finely chopped. Mix all well together with a little French dressing. Arrange dome-shape on a shallow serving dish, sprinkle over with grated carrot, and serve with water biscuits.

COOLING MILK DRINKS.

The following recipes, which have been tested by the American National Dairy Council, provide considerable variation and new ideas for summer use. They were suggested to those participating in a ''Dairy Month'' held in the States recently. This was a nation-wide campaign, sponsored by the Institute of Distribution Inc., with the object of increasing the consumption of milk:—

Lemon Milk Punch.

Two eggs, ½ cup ice water, 3 cups milk, 6 tablespoonfuls lemon juice, ½ cup sugar. Beat eggs, add water, lemon juice, and sugar, mixing thoroughly. Add slowly to the cold milk, stirring constantly. Serve at once. Yield: 4 or 5 glasses.

Milk and Honey Nectar.

One-third cup mashed banana, 1½ tablespoonfuls orange juice, 1½ tablespoonfuls honey, 1 drop almond extract, pinch salt, 1 cupful milk. Mash banana. Add fruit juice, honey, salt, and flavouring. Mix well. When ready to serve, add cold milk and beat with egg beater. Garnish with whipped cream and serve immediately. Yield: 1 tall glass.

Apricot Milk Shake.

Half cup apricot nectar, 1 teaspoonful lemon juice, 1 cup milk, 1½ tablespoonfuls sugar, pinch salt. Dissolve the sugar and salt in the apricot and lemon juice and chill. When ready to serve pour into the cold milk and mix well. Serve immediately. Yield: 1 tall glass.

Fruit Milk Punch.

Half crushed banana, 2 tablespoonfuls orange juice, ¼ cup pineapple juice, 1 tablespoonful lemon juice, pinch salt, 1 cup milk. Mash banana. Add fruit juice and salt; chill. When ready to serve, pour into cold milk and beat with egg beater. Serve immediately. Yield: 1 tall glass.

Prune-Ade.

Half cupful prune juice, 1 teaspoonful lemon juice, 1 cupful milk, 2 tablespoonfuls sugar, pinch salt. Dissolve the sugar and salt in the prune and lemon juice and chill. When ready to serve, pour into the cold milk and mix well. Serve immediately. Yield: 1 tall glass.

Grape Blossom.

Half cupful grape juice, ½ teaspoonful lemon juice, pinch salt, 2 tablespoonfuls sugar, 1 cupful milk. Combine chilled ingredients and beat with egg beater. Serve immediately. Yield: 1 tall glass.

Strawberry Milk Drink.

One quart strawberries, 5 cupfuls milk, 2½ teaspoonfuls lemon juice, ¾ cupful sugar, ¼ teaspoonful salt. Wash, hull, and drain strawberries. Crush and press through a coarse sieve. Combine puree with milk, add other ingredients, and mix thoroughly. Chill before serving. Garnish with whipped cream. Yield: 8 to 10 servings.

Plate 84.
THE LEICHHARDT RIVER AT KAJABBA, NORTH-WESTERN QUEENSLAND.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF DECEMBER IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1939 AND 1938, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of years' records.	Dec., 1939.	Dec., 1938.
North Coast.	In.		In.	In.
Atherton	7·14	38	4·89	1·20
Cairns	8·59	57	1·04	4·19
Cardwell	8·10	67	0·81	2·86
Cooktown ..	6·53	63	0·99	3·87
Herberton ..	5·66	53	4·11	0·96
Ingham	6·79	47	1·81	1·12
Innisfail	11·55	58	1·40	3·08
Mossman Mill ..	9·91	26	4·37	3·15
Townsville ..	5·35	68	0·47	0·17
Central Coast.				
Ayr	3·88	52	2·58	0·50
Bowen	4·34	68	1·89	..
Charters Towers ..	3·20	57	1·59	0·06
Mackay P.O. ..	6·97	68	3·10	1·61
Mackay Sugar Experiment Station	7·84	42	..	1·91
Proserpine ..	7·42	36	3·38	0·57
St. Lawrence ..	4·66	68	3·26	0·86
South Coast.				
Biggenden ..	4·58	40	4·52	1·45
Bundaberg ..	5·00	56	9·90	0·23
Brisbane	4·84	87	3·28	0·41
Caboolture ..	5·14	52	3·80	0·27
Childers	5·61	44	4·82	0·94
Crohamhurst ..	7·08	46	2·52	0·24
Esk	4·60	52	4·52	..

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Dec.	No. of years' records.	Dec., 1939.	Dec., 1938.
South Coast—contd.	In.		In.	In.
Gatton College ..	3·67	40	..	0·05
Gayndah	4·12	68	4·55	0·10
Gympie	5·38	69	5·02	1·91
Kilkivan	4·51	60	3·56	0·29
Maryborough ..	5·01	68	4·24	0·34
Nambour	6·61	43	3·05	0·54
Nanango	3·75	57	3·77	0·26
Rockhampton ..	4·74	68	3·53	1·01
Woodford ..	5·42	52	4.13	0·08
Central Highlands.				
Clermont ..	3·75	68	2·92	1·45
Gindie	2·72	40	1·14	0·48
Springsure ..	3·19	70	2·90	0·29
Darling Downs.				
Dalby	3·29	69	4·90	0·23
Emu Vale ..	3·41	43	1·75	0·79
Hermitage ..	2·94	33	..	..
Jimbour	3·23	51	6·03	..
Miles	3·09	54	1·39	0·06
Stanthorpe ..	3·57	66	2·85	1·48
Toowoomba ..	4·39	67	5·98	0·30
Warwick	3·41	74	3·07	0·56
Maranoa.				
Bungeworgorai ..	2·84	25	..	..
Roma	2·52	65	1·43	..

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—DECEMBER, 1939.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·87	90	75	92	31	71	14, 15 29	99	6
Herberton	..	85	63	94	7	55	8	411	6
Rockhampton	29·92	90	71	98	5	64	8	353	10
Brisbane	29·98	83	67	94	1	61	11	328	12
Darling Downs.									
Dalby	29·95	89	62	96	5	51	1	490	8
Stanthorpe	..	83	56	91	22, 23	40	1	285	9
Toowoomba	..	82	59	90	23	49	6	598	12
Mid-Interior.									
Georgetown	29·86	98	71	104	6	67	15	577	13
Longreach	29·86	100	70	106	16,17, 27	51	8	47	3
Mitchell	29·89	94	65	100	26	50	7	62	2
Western.									
Burketown	29·86	98	76	107	15	69	11	700	7
Boulia	29·80	101	72	110	18	63	8	..	..
Thargomindah ..	29·83	97	69	110	18	59	6	71	2

ASTRONOMICAL DATA FOR QUEENSLAND.

Times Computed by A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	February, 1940.		March, 1940.		MOONRISE. Feb., 1940.	MOONRISE. March, 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	p.m.
1	5·25	6·46	5·46	6·24	..	11·36
2	5·26	6·46	5·46	6·23	12·2	a.m.
3	5·27	6·45	5·47	6·22	12·49	12·29
4	5·27	6·45	5·47	6·21	1·40	1·22
5	5·28	6·44	5·48	6·20	2·31	2·15
6	5·29	6·43	5·48	6·19	3·25	3·8
7	5·29	6·43	5·49	6·18	4·15	3·58
8	5·30	6·42	5·49	6·17	5·12	4·49
9	5·31	6·41	5·50	6·16	6·5	5·41
10	5·32	6·40	5·51	6·15	6·54	6·38
11	5·32	6·39	5·51	6·13	7·45	7·19
12	5·33	6·38	5·52	6·12	8·34	8·11
13	5·34	6·38	5·53	6·11	9·26	9·6
14	5·35	6·37	5·53	6·10	10·17	9·57
15	5·35	6·36	5·54	6·8	11·6	10·53
					p.m.	
16	5·36	6·36	5·54	6·7	12·3	11·44
						p.m.
17	5·37	6·35	5·55	6·6	12·56	12·39
18	5.37	6·34	5·55	6·5	1·55	1·30
19	5·38	6·33	5·56	6·4	2·47	2·21
20	5·39	6·33	5·56	6·3	3·42	3·8
21	5·39	6·32	5·57	6·2	4·35	3·56
22	5·40	6·31	5·57	6·1	5·25	4·44
23	5·41	6·30	5·58	6·0	6·12	5·31
24	5·41	6·29	5·58	5·59	6·56	6·15
25	5·42	6·28	5·59	5·58	7·42	7·1
26	5·43	6·27	5·59	5·57	8·26	7·48
27	5·43	6·26	6·0	5·56	9·14	8·37
28	5·44	6·25	6·0	5·55	9·59	9·29
29	5·45	6·24	6·0	5·54	10·47	10·22
30	..	..	6·1	5·53	..	11·15
31	..	..	6·1	5·52	..	..

Phases of the Moon, Occultations, &c.

1st	Feb.	☾	Last Quarter	12 47 a.m.
8th	,,	●	New Moon	5 45 p.m.
16th	,,	☽	First Quarter	10 55 p.m.
23rd	,,	○	Full Moon	7 55 p.m.

Apogee, 11th February, at 12 noon.
Perigee, 24th February, at 8 a.m.

The Moon, in its monthly journey through the 12 zodiacal constellations, must in turn pass all planets, above or below our horizon. During this month it will pass Venus on the 12th and Jupiter on the 13th in Pisces, and Saturn and Mars on the 14th in Aquarius, which shows how near the planets are to each other.

The rare and interesting gathering of four "wandering stars," Jupiter, Venus, Mercury, and Saturn, and their varying positions above the eastern horizon in the early morning hours of April and May last, will now be repeated in the western sky, moreover, with the addition of Mars.

On the 7th of last month the Martial planet passed to the eastward of Jupiter; on the 13th of this month it will overtake and pass Saturn; on the 20th the two most beautiful planets, Venus and Jupiter, will be seen very near each other, within two hours after sunset. On the 28th, when Mercury will be at its greatest altitude, 18 degrees above the western horizon, we shall see the five planets visible to the naked eye, and our Earth, on which we run against one another, moves in perfect harmony with the heavenly bodies, and all the planets rise and set with regularity unhindered, as of old.

Mercury rises at 5.24 a.m., 1 minute before the Sun, and sets at 6.53 p.m., 7 minutes after the Sun, on the 1st; on the 14th it rises at 6.21 a.m., 46 minutes after the Sun, and sets at 7.13 p.m., 36 minutes after it.

Venus rises at 8.7 a.m., 2 hours 42 minutes after the Sun, and sets at 8.40 p.m., 1 hour 54 minutes after it; on the 14th it rises at 8.27 a.m., 2 hours 52 minutes after the Sun, and sets at 8.31 p.m., 1 hour 54 minutes after it.

Mars rises at 10.37 a.m., and sets at 10.6 p.m., on the 1st; on the 14th it rises at 10.27 a.m., and sets at 9.39 p.m.

1st	Mar.	☾	Last Quarter	12 35 p.m.
9th	,,	●	New Moon	12 23 p.m.
17th	,,	☽	First Quarter	1 25 p.m.
24th	,,	○	Full Moon	5 33 a.m.

Apogee, 9th March, at 3.0 p.m.
Perigee, 23rd March, at 10 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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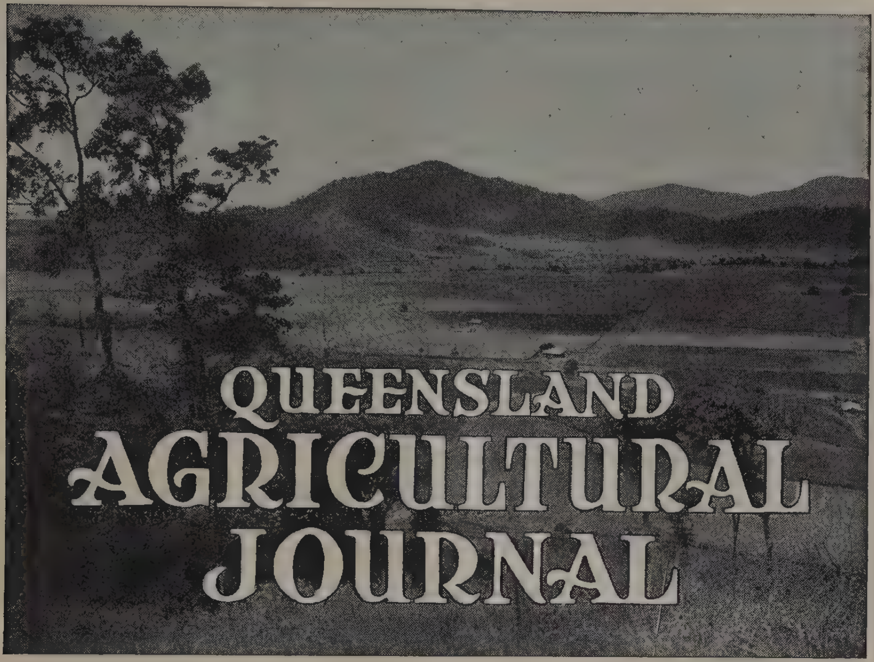

QUEENSLAND AGRICULTURAL JOURNAL

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The Australian Council of Agriculture.

UNTIL 1933 it was customary for State Ministers of Agriculture to confer annually on agricultural problems of general Commonwealth interest. This Council of Ministers did a great service to the land industries of Australia, for, among other things, it paved the way for a united approach to matters of Commonwealth-wide concern. However, as time went on the Ministers' Conference was burdened by the intrusion of economic factors which were particularly under the control of the Federal Government. Then followed the establishment of the Council for Scientific and Industrial Research, and its activities made direct contact with the representatives of every State desirable. Ultimately this was achieved by the formation of the Australian Council of Agriculture, which consists of the State Ministers of Agriculture, the Federal Minister of Commerce, and a representative of the new Commonwealth Ministry of Supply and Development. In addition, there is a standing committee consisting of the permanent heads of the State Departments and the executive of the Council for Scientific and Industrial Research.

It will be seen, therefore, that the Australian Council of Agriculture as constituted is capable of surveying cultural, economic, scientific, and research problems, and of making decisions acceptable by the Governments concerned. The Commonwealth maintains a permanent secretariat so that, as necessity arises, continuous consultations are possible between the components of the Council.

In discussing the scope and work of the Council recently, the Minister of Agriculture and Stock, Hon. Frank W. Bulcock, remarked that the deliberations of such a body tend to make agriculture a national rather than a State activity. It brought about a recognition of the fact that Australia is essentially agricultural and that many of its scientific and economic problems are Commonwealth-wide.

During the six years he had been associated with the Council Mr. Bulcock said he had found a real desire on the part of the Council to co-ordinate all forms of agricultural activity, and at the same time to conserve the specific field of every individual State.

As the Commonwealth has no Department of Agriculture—and in this it differs from many other federations, the United States of America being an outstanding example—but controls bounties and Customs, and, through the Federal research organisation, exercises a wide influence on the scientific factors of production, it will be readily apparent that a body that represents the three phases of agriculture is essential to prevent overlapping and misunderstandings.

Agricultural Co-ordination.

CONTINUING, Mr. Bulcock said that the co-ordination of agricultural experiment and research programmes was by no means easy of accomplishment, for it was found that personal factors and State considerations were frequently a bar to the pooling of the sum total of knowledge available.

As a result, each State tended to make its work a partial secret. This led to duplication of effort and a considerable wastage of the time of highly trained and skilled workers. So one of the first matters tackled by the newly constituted Council of Agriculture was the preparation of statements showing the work each State was engaged upon, and from this arose a co-ordinated policy that allows for and requires the free exchange of information and results as between the States. From time to time, too, technical officers drawn from each State meet to discuss matters relating to their particular activity.

Happily, the Council for Scientific and Industrial Research is fundamentally co-operative. One achievement of outstanding importance to Queensland was the work of the Council in relation to the export of chilled beef.

Mr. Bulcock went on to say that there were, of course, some people who were impatient for results, but it had to be remembered that the Council for Scientific and Industrial Research had inherited the accumulated problems of agriculture which emerged during the first century of our history. Routine problems were, of course, solved by States as they arose, but the major legacies which fell to the lot of the Council were those difficult problems which had defied or resisted routine investigation. He referred to the dissipation of earlier effort in relation to scientific investigation.

In regard to some important stock diseases particularly, each State was doing some work, but no State was financially able to launch a full-time investigation.

Eventually—in pursuit of the principle laid down by the Council of Agriculture in relation to co-operation—Victoria was financed to specialise in the study of mastitis, and New South Wales undertook investigational and research work in respect of contagious abortion. Thus, for an expenditure of only a few hundred pounds a year, Queensland gets a research service costing from £8,000 to £10,000 a year.

By these means, the problems associated with these and other stock diseases will probably be solved for the benefit of the Commonwealth as a whole.

During its relatively brief life, continued Mr. Bulcock, the Australian Council of Agriculture had been confronted by some difficult problems, but none more difficult than that of the application of quotas to primary exports. During those difficult days we lived in a state of uncertainty, hesitant about agricultural expansion and apprehensive about the security of our existing markets. There were people in those days who advocated restriction of production. The view of the Council of Agriculture was that restriction should be resisted all the way.

In the light of its achievements, he claimed modestly that the Council had fully justified its existence and had done its part in the stabilisation of the economics of primary production.

During recent months members of the Council had been required to give close attention to the marketing problems arising out of the war, said the Minister. Of course, the basis of sales transactions was always just what the purchaser was prepared to give, but it was to the credit of Australia that no sales agreement had been entered into on a profiteering basis. So far as he knew, Australia, in relation to sales, did not propose any basis which could have been so construed. A review of the course of these agreements showed how difficult they were to complete.

Post-war planning was certainly the biggest question listed at the Hobart Conference in February. All States spoke on the matters involved. There was a general feeling among members that the matter was urgent, but the query was: How is it to be approached?

The conference was, however, in agreement on two matters—that the volume of primary export during the war should constitute the minimum basis for post-war exports in the event of quotas being reimposed; and that the Commonwealth should immediately investigate all the circumstances surrounding crops which at present do not yield sufficient to satisfy Australian requirements.

Such an adjustment might, and possibly did, mean an alteration in bounties, excise, and Customs, but with the inevitable contraction in exports during the post-war period, such a course was clearly indicated as necessary for stability in domestic agriculture, and would, to a degree—however small—make for stabilisation during what promised to be an exceedingly difficult period.

Concluding, Mr. Bulcock affirmed his belief in the soundness of the principles underlying a planned agriculture. It would be impossible, he said, for the leading agriculturists of the Commonwealth—cultural, scientific, and economic—to meet and not achieve something of lasting worth to the nation. The Council was, of course, subject to Federal and State Governments, but it had already become the logical clearing house for Australian agriculture.

Pineapple Culture in Queensland.

H. K. LEWCOCK, M.Sc., B.Sc.Agr., Senior Research Officer.

(Continued from page 44, January, 1940.)

CHAPTER V.—SOIL REQUIREMENTS OF THE PINEAPPLE.

BECAUSE of its epiphytic relationships (vide Chapter II., p. 618, Vol. LII., Part 6, December, 1939), the pineapple is extremely sensitive to conditions which impede the respiratory activity or breathing of its roots. Such conditions occur in compacted, shallow, or wet soils. The suitability of a soil for pineapple culture is, therefore, determined chiefly by those properties which control soil aeration and the movement and retention of soil moisture. An adequate supply of the mineral nutrients required by plants and freedom from adverse chemical conditions, such as an unfavourable soil reaction, are also essential, but it is usually much easier to remedy nutritional deficiencies in soils used for pineapple culture than it is to modify the conditions which determine their aeration and moisture relationships. This is because the moisture relationships in the zone of root penetration are greatly influenced by the structure and composition of the soil layers which lie below the level at which cultivation is practicable and which, in consequence, have to be taken very much as they are found. From the practical point of view it is accordingly important to give attention to the factors influencing the movement and retention of air and water in soils before considering questions of soil fertility and management.

SOIL PROPERTIES INFLUENCING THE SUITABILITY OF SOILS FOR PINEAPPLE CULTURE.

Soils consist principally of the mineral particles which result from the disintegration and decomposition of rocks. In addition, most soils contain some organic material derived from decaying plant and animal remains. Organic matter which has decayed to the extent that its original cellular structure has been lost is known as *humus.*

The proportions in which different-sized particles occur in the various layers of a soil, the manner in which these soil particles are aggregated, and the amount and nature of the organic matter which is present determine those properties of a soil on which its aeration and moisture relationships depend. The most important of these properties, and the ways in which they influence the suitability of soils for pineapple culture, are as follows:—

Soil Texture.

According to size, soil particles are classed as clay, silt, sand, or gravel, clay consisting of the smallest particles and gravel the largest. Most soils contain clay, silt, and sand, and it is the proportions in which these various sized particles are present in a soil which determine its texture or "feel." Fine-textured soils consist largely of clay, and coarse-textured soils of sand. Intermediate between these extremes come the loams, that is, soils in which the various sized particles are mixed in such proportions that they do not especially reflect the characteristics of any one.

Though frequently rich in mineral plant foods, fine-textured soils become sticky when wet and generally tend to form clods and surface crusts when drying out. For this reason they are difficult to cultivate. While they are highly retentive of moisture, movement of water in fine-textured soils is notably slow, so that they neither moisten readily nor drain freely. When exposed to heavy and continuous rainfall, therefore, they tend to become water-logged, with the consequent exclusion of air. Only when their structure is particularly open can fine-textured soils be regarded as suitable for pineapple culture. In contrast, coarse-textured soils are loose and friable, extremely porous, and very easy to cultivate. For pineapple culture, however, they suffer from the disadvantage that their extreme permeability to water causes the surface layers to dry out very rapidly unless they contain a high content of organic matter. Moreover, coarse-textured soils are frequently extremely deficient in available mineral plant foods. Though actually heavier in weight than those of finer texture, sandy soils are often spoken of as ''light'' soils because of the ease with which they may be tilled; similarly, soils which are difficult to cultivate are frequently referred to as ''heavy'' soils. In moderation, stones and gravel have a beneficial effect on the texture of heavy soils since they offset to some extent the undesirable properties of clay.

Medium-textured soils comprise the loams, and these are generally the most suitable for pineapple culture because their aeration and moisture-retaining properties are intermediate between the extremes presented by the clays and sands. However, the value of loams as pineapple soils may be greatly modified by the textural and structural properties of the subsoils which underlie them. For example, in subtropical regions, such as southern Queensland, a relatively impervious layer of fine cemented material may sometimes occur a few inches below the surface of loams and sandy loams which greatly impedes drainage. Formations such as this should be avoided for pineapple culture, irrespective of the nature of the top soil.

Since soil texture is determined by the size of the soil particles which compose it, this property can be altered only through the addition of soil of another texture. Occasionally, it is possible to effect an improvement in the texture of a shallow sandy soil by gradually increasing the depth to which it is ploughed, as in this way fine material which has been washed down and deposited below the normal level of cultivation is brought to the surface again. Apart from this, there is nothing that can be done in a practical way to change the texture of a soil, but the influence of texture on the aeration of a soil and its moisture relationships may be considerably modified by changes in its structure.

Soil Structure.

In contrast to texture, which is dependent on the size of the particles making up a soil, structure is determined by the manner in which these particles are arranged with reference to one another. They may exist either as single particles or clustered together in groups. A soil in which the particles adhere together in clumps is said to possess a *crumb* structure, and on the extent to which this is developed largely depends the permeability of a soil to air and water, and its capacity to retain moisture and release it to growing plants. A favourable structure in both the surface and subsoil layers is an essential requirement for a pineapple soil. In southern Queensland the presence of a closely-compacted, impervious sub-surface layer in the soils of sloping lands may result not only in poor drainage but also in greater susceptibility to erosion.

The structure of a soil is shown by the way in which it behaves under cultivation. Clay particles possess a natural tendency to cling together while coarser particles lack this tendency. Thus a good loam falls apart easily to reveal a characteristic crumb-like structure, while a clay loam may need additional cultivation to make it crumble, and the resulting crumbs will be larger than in a loam proper. On the other hand, sandy soils, and especially those with a low content of organic matter, have a tendency to fall apart into such a fine state of division that the component particles may be individually recognised. Such soils are said to possess a *single grain* structure.

Apart from the proportions of clay or sand which a soil may contain, *i.e.*, its textural properties, the structure of a soil is greatly influenced by (*a*) its humus content and (*b*) cultivation practices. Soils of all kinds tend to develop a desirable crumb structure under the influence of humus, because humus promotes the binding together of both fine and coarse textured particles into aggregates or clumps which are looser and more spongy in character, and more variable in size, than those formed when clay is the cementing agent. It follows, therefore, that maintenance of a soil structure favourable for pineapple growth is dependent on keeping the soil well supplied with organic matter. The problem of renovating old pineapple land in Southern Queensland is largely a matter or re-establishing a favourable soil structure; hence the marked improvement which results from the ploughing under of trash and bulky cover crops, such as maize and crotalaria. A similar effect is produced on old banana land by a few years' growth of lantana, due to infiltration of humus formed from decaying leaves and roots.

Cultivation may exert either beneficial or harmful effects on soil structure, depending on the type of soil and the conditions under which it is carried out. The ploughing of heavy soils when either too moist or too dry results in the formation of clods, which are difficult to work down into a suitable tilth. On the other hand, repeated cultivation of a heavy soil after it has lost all trace of stickiness is beneficial, because at this moisture content the formation of a desirable crumb structure is promoted by exposing the soil to air. Under warm, humid conditions, however, excessive cultivation or exposure leads to a rapid depletion in the humus content of a soil and may thus adversely affect its structure. This is particularly true of the medium and coarse textured soils which are chiefly used for pineapple culture in the coastal districts of Southern Queensland.

However, the principal cause of loss of structure in these and other soils used for pineapple culture in Queensland is erosion. Crumb structure in a soil is generally most highly developed near the surface, because of the relatively greater amounts of organic matter which are contained there. By washing away the surface layer, erosion not only leads to rapid deterioration in the structure of a soil, but may also change its texture. Changes in soil structure due to erosion ordinarily do not take place until land has been brought under cultivation. Consequently, the extent to which a cultivated soil has retained its original structural properties—as exemplified in the soil of adjacent timbered country—is a good indication of the degree of efficiency which has been employed in its management. Loss of soil structure brought about by erosion or too rapid decomposition of humus, or both, is chiefly responsible for the rapid deterioration in productivity which occurs all too commonly in pineapple soils in southern Queensland.

Pore Space.

The particles making up a soil do not fit snugly together, but are separated by cavities which, collectively, form the pore space. The proportion of pore space in a soil is determined both by its texture and by its structure. In very sandy soils—that is, soils in which the particles are not aggregated into crumbs—it may not exceed 30 per cent. of the total volume, while it may account for 50 per cent. of the volume of a fine-textured soil with a well-developed crumb structure, such as a clay loam. Conditions which favour the development of a crumb structure in a soil increase the pore space, while a loss of humus or the compacting of the soil particles reduce it. In cultivated soils, pore space is at a maximum after ploughing, and gradually diminishes as the soil settles down under the impact of rain. Trampling on a soil also reduces its pore space.

The pore space of a soil is filled with air and water. In a friable loam, the most favourable conditions for the development of pineapple roots occur when air and water are present in the pore space in approximately equal proportions—that is, a cubic yard of soil should contain about 6 cubic feet of air. Where the drainage is good, this condition is attained within a day or two following saturation of the soil with rain. As a general rule, the pore space in a soil decreases from the surface downwards, due to the lower humus content and the consequent deterioration in structure. The development of pineapple roots in a soil is confined to those layers in which there is a free circulation of air. Anything which leads to a diminution in the pore space of the cultivated layer of a soil reduces the amount of air it can hold, and may thus adversely affect the supply of air to the roots. Consequently, to maintain the pore space of a soil in a condition which will favour root growth, it is important to prevent it both from losing its structure and from becoming compacted. Covering the soil with a protective layer of mulch is a particularly effective means of preserving its porosity.

MOISTURE RELATIONSHIPS.

The moisture relationships of a soil refer to the manner in which texture, structure, and other soil properties influence the supply of air and water to plant roots. Aeration and the supply of water are intimately related because an increase in the moisture content of a soil reduces the amount of air which is present in the pore spaces, and *vice versa*. In addition, the moisture relationships of a soil largely determine the intake of nutrients by a plant, partly because roots can absorb only substances which are in solution, and partly because the chemical changes by which minerals are rendered available to plants can take place only in the presence of air and water.

Soils differ greatly in their moisture relationships, even under similar climatic conditions, and it is these differences which chiefly determine their suitability for pineapple culture. If the moisture relationships of a soil are favourable for the production of this crop, it will invariably repay generous fertilizer treatment, while if they are unsatisfactory, application of fertilizer alone will not materially increase its productivity.

The moisture relationships of a soil are determined chiefly by (1) its permeability and (2) its capacity to hold water.

After soaking rain, air is forced out of the surface layers of a soil because the pore spaces become filled with water. Since fresh rainwater contains appreciable quantities of dissolved oxygen, however, plant roots are affected only if the period of saturation is prolonged—that is, if the excess water is unable to drain away freely. In a well-drained soil, much of the water which enters at the surface in the form of rain quickly percolates downwards to lower levels, thus permitting the re-entry of air into the pore spaces of the root zone.

Permeability.

The downward movement of excess water in a soil takes place under the influence of gravity, and its rate of flow depends on the permeability of the soil, which is determined by the relative size or diameter of the soil pores. Thus permeability depends partly on soil texture and partly on soil structure. For example, percolation through a fine-textured soil (i.e., a clay) which lacks a crumb structure is much slower than it is through a coarse-textured sand, even though the former has the greater total pore space, because the channels between the clay particles are much narrower than they are in sand. If a fine-textured soil possesses a well-developed crumb structure, however, the pore spaces will be larger and downward movement of water will be facilitated. From this it follows that heavy soils can be regarded as suitable for pineapple culture only when they exhibit an open structure—that is, when their humus content is high. It is essential also that the structure of the subsoil layers is such as will permit the ready escape downwards of excess water; this applies not only to heavy soils but to coarse-textured soils as well.

Water Table.

Unless it is lost by evaporation, moisture which gravitates downwards ultimately reaches a level at which the soil is permanently saturated with water. This is known as the *water table*. In any given soil, the depth at which the water table lies varies somewhat with the season and the year, but, in the absence of impervious layers, it generally follows the contour of the land. The water table has little effect on the moisture relationships in the cultivated layers of a soil unless it lies within a few feet of the surface.

Field Moisture Capacity.

Above the level of the water table, the amount of moisture which is present in a soil depends chiefly on (1) the rate at which water is entering the soil in the form of rainfall, and (2) the rate at which it is being lost by transpiration through plants and by evaporation into the air. The maximum amount of moisture which a soil can hold after it has been thoroughly wetted and all free or excess water has drained away is known as its *field moisture capacity*. The field moisture capacity is of practical importance because it represents approximately the upper limit at which a soil can supply water to plants. Prolonged retention in a soil of moisture above this limit is a certain indication of defective drainage and inadequate aeration—i.e., waterlogging. The field moisture capacity of a soil is greatly influenced by its content of clay and organic matter, particularly the latter. Both of these soil constituents retain water in a manner similar to that in which it is held by a jelly. This results in a swelling of the particles. While clay takes up only a little more than its own volume of water, however, humus can adsorb from four to five times as much. Sand particles do not possess the capacity of adsorption and swelling, and they are unable to hold water except as thin films on their surfaces. For this reason, fine-textured soils usually possess a higher field moisture capacity than coarse-textured soils, while a similar, but proportionately greater, difference exists between soils which are well supplied with organic matter and those which are deficient in this constituent.

Wilting Point.

Plants cannot extract all of the water which remains in a soil when the moisture content is at field moisture capacity. As a soil dries, the pull of the soil particles on the moisture present becomes stronger until finally plant roots are unable to get water quickly enough to make good that lost by transpiration from the leaves, and growth comes to a standstill. At this stage, the moisture content of the soil is said to have been reduced to the *wilting point,* because plants whose leaves are not structurally adapted to withstanding severe drought conditions will droop and die as soon as it is reached. Anatomically, pineapple leaves are so constructed that the rate of transpiration is greatly reduced whenever there is a falling-off in the intake of water by the roots (*vide* Chapter II.). Consequently, drooping of the foliage does not immediately occur in this plant when the moisture content of the soil reaches the wilting point; in fact, development of wilt symptoms in the pineapple may be arrested by a renewal of the water supply even after a period of several weeks unless the roots themselves have suffered injury or decay. For this reason, the occurrence of the collapsed condition known as ''pineapple wilt'' is almost always indicative of partial or complete failure of the root system; it is therefore more often related to an excessive rather than a deficient supply of soil moisture, since an excessive amount of moisture in the soil implies inadequate aeration, and in the absence of air roots cannot live.

Available Moisture Capacity.

Though pineapples may live for a long time without much water intake they do not grow. It is of practical importance to know, therefore, how much water a soil is capable of supplying to crops which are grown on it—that is, its *available moisture capacity.* This is represented by the difference between the wilting point and the field moisture capacity, since the former is the point at which moisture becomes unavailable to plants and the latter is the maximum amount it can hold after all excess water has drained away. While the wilting point for any given soil remains constant, it varies widely for different soils, depending on their texture and capacity for water retention. Fine-textured soils have relatively high wilting points and sandy soils low ones. Consequently, sandy soils can supply water to plants down to a much lower moisture content than clays. In practice, this means that after a prolonged dry spell, during which the moisture content of a soil has been reduced below its wilting point, much less rain will be required to make water again available for plants on a sandy soil than on a heavy one. On the other hand, heavy soils can hold much greater amounts of water than sandy ones because of the adsorptive properties of the clay which they contain. In view of the pronounced alternation of wet and dry seasons which occurs along the entire Queensland coast, it is evident that the soils which are best adapted for pineapple-growing in this State are those which combine a low wilting point with a relatively high field capacity—that is, soils which are able not only to retain a large amount of usable water, but which respond quickly to rain after drying out. These requirements are best met by sandy loams, particularly those which are well supplied with humus.

The relation which exists between field moisture capacity, wilting point, and moisture-availability in several soils representative of those used for pineapple-growing in southern Queensland is illustrated in the following table:—

Type of Soil and Location.*	Wilting Point.	Field Moisture Capacity.	Available Moisture Capacity.
	Per cent.	Per cent.	Per cent.
Sand (Nambour district)	3·4	4·1	0·7
Fine sand (Beerburrum district)	3·6	5·1	1·5
Sandy loam (Glass House Mountains district) ..	4·5	9·4	4·9
Sandy loam (Nambour district)	5·9	10·4	4·5
Clay loam (Nambour district)	24·0	32·6	8·6

* All samples taken to a depth of nine inches.

Of these soils, the two sandy loams may be regarded as typical of the best pineapple soils in southern Queensland. Analyses show that the proven superiority of soils of this type, when properly managed, lies almost entirely in their moisture relationships since their content of available plant foods is uniformly low. By comparison, it will be evident that a sandy soil is less suitable than one of a loamy texture: in consequence of its lower capacity for retaining moisture in a form available to plants, the moisture content of a sandy soil is quickly reduced below the wilting point whenever a dry period occurs. On the other hand, while soils which contain appreciable quantities of clay possess much greater field moisture capacities than sands, or even loams—unless the latter are very rich in humus—crops grown on them may suffer from acute water shortage at certain times of the year, due to the fact that a considerable fall of rain may be required to raise the moisture content of a dried-out, clayey soil above the wilting point. For example, addition of water equivalent to a fall of approximately 150 points of rain are required to bring the moisture content of the top 6 inches of the clay loam (Nambour district) up to the wilting point after it has become thoroughly dry. Allowing for losses due to evaporation and run-off, it will be seen that, following a prolonged dry period, anything less than a fall of 2 inches on a soil of this type has little value as far as a shallow-rooting crop, such as the pineapple, is concerned. However, in the sandy loam (Nambour district), under similar conditions, water again becomes available for shallow-rooting crops after a fall of 50 points, and a lesser amount is required in the case of the sandy loam (Glass House Mountains district). Quite apart from considerations of drainage and aeration, therefore, clayey soils are likely to prove inferior to sandy loams for pineapple culture in regions where there is marked irregularity in the seasonal distribution of the rainfall. To a greater or lesser degree, this applies to the whole of the Queensland coast.

Movement of Moisture in the Soil.

For the bulk of its water supply, the pineapple depends on the moisture which is contained in the first foot of soil; few roots penetrate below this depth and those which do are relatively inefficient in the absorption of water owing to the sparse development of root hairs on them, consequent on an inadequate circulation of air at deeper levels.

As previously explained, water in excess of the field moisture capacity of the root zone normally drains away to deeper levels under the influence of gravity. All except a very small fraction of that which remains is either absorbed by the roots of plants or evaporated into the atmosphere. Replenishment of the moisture supply in the root zone is effected almost entirely by water which enters the soil from above. Soils in which the moisture relationships of the surface layers are appreciably influenced by the rise of subsoil moisture are generally quite unsuited for pineapple culture, because such a condition is indicative either of a high water table or of very fine pore cavities and a consequent lack of aeration. At one time the view was held that water could rise from a considerable depth to make up the losses which occurred from the surface layers, but it is now known that upward movement of water in soils is confined to relatively short distances. Even in heavy loams the lift does not exceed 2 or 3 feet, while in light sandy soils it may not be more than a few inches. Lateral or sideways movement of water in a soil also takes place very much more slowly than was formerly thought to be the case. In the absence of water percolating down slopes, soil protected from rainfall remains dry for a considerable period even when it is surrounded by soil which is maintained in a thoroughly moistened condition. For example, it has been found that, in a sandy loam, a period of from five to six weeks elapses following heavy rain before soil under the middle of a 3-feet wide strip of paper mulch shows any appreciable rise in its moisture content. Obviously, therefore, the moisture content of a soil should be at or near its field capacity before paper mulch is laid on it.

Downward movement of water in a soil occurs only when its moisture content approximates to its field capacity; until this point is reached, the attraction of the soil particles for water is stronger than the pull of gravity. Thus the rate at which rain penetrates a dry soil provides a very good indication of its field moisture capacity; e.g., a sandy soil which is deficient in humus wets much more quickly than one which contains an appreciable quantity of leaf mould or other decaying plant remains. Consequently, in a soil which possesses a high field moisture capacity, the wetting effect of light showers does not extend for more than a few inches below the surface. Plants can make use of this water provided their roots lie within the zone of moisture penetration. However, roots develop near the surface of a soil only when the moisture content of the surface layers is habitually in excess of the wilting point. In the case of the pineapple, some of the water which collects almost daily in the leaves in the form of dew eventually finds its way to the soil at the base of the stem, and root development is largely confined to this region because of the favourable moisture conditions which exist there (vide Plate 262; Chapter II.). For this reason, the pineapple plant is able to obtain a considerable proportion of its water requirements, not only from dews, but also from falls of rain so light in character that they do not appreciably affect the moisture content of the soil as a whole. This explains the disparity between the size of the aerial organs of the pineapple plant (stem, leaves, and fruit) and that the root system which nourishes them. Among growers it is a frequent cause of amazement that so small a root system can support such a large and vigorously-growing plant structure. Because the spread of the root system is so restricted, however, the maintenance of soil conditions favourable to its efficient functioning is a matter of the greatest practical importance. Particularly, it is necessary to insure that as little as possible of the moisture collected by the leaves is lost from the soil by evaporation into the air.

Loss of Soil Moisture by Evaporation.

Loss of soil water by direct evaporation into the atmosphere is greatest at the surface and decreases with increasing depth. This is due not only to the freer circulation of air which occurs in the surface layers, but also to the heating effects of the sun's rays, since the amount of moisture which air can hold in a vaporised or gaseous form is determined by its temperature. In providing optimum soil conditions for pineapples, therefore, the grower is faced with the problem of minimising water loss in that part of the soil from which evaporation is greatest. Free circulation of air around the roots is just as essential for pineapples as an adequate supply of moisture: in the absence of one, the other is of no value. While evaporation of water from a well-aerated soil cannot be entirely prevented, it can be greatly reduced by protecting the surface from the drying influence of wind and from exposure to the sun's rays, i.e., by shading. Investigations carried out in Europe have shown that, on bare exposed soil, 30 per cent. of the total rainfall is lost from the soil by direct evaporation into the atmosphere, while only 7 per cent. is lost under natural beech forest. Although no figures are available, it is reasonable to suppose that in humid tropical and sub-tropical regions, the difference in the rate of evaporation from bare and shaded soil would be considerably greater, due both to the denser nature of the vegetation on virgin soil and the higher temperatures in the surface layers of bare soil. A stand of vegetation or other surface cover not only shades the soil from the sun's rays, but also affords it some protection against the drying influence of winds. By removing moisture-laden air from the soil surface wind greatly accelerates the rate of water loss, particularly when the atmospheric humidity is low. The westerlies which sweep across Queensland during the late winter and early spring often dry out the cultivated soils of the coastal districts to such an extent that shallow-rooting crops such as the pineapple experience difficulty in meeting their water requirements in the months that follow. Evaporational watèr loss at this and other times of the year may be greatly reduced by the employment of mulches of various kinds and by spacing the plants so that their leaves form a protective covering over the whole of the soil surface. Within the limits that are defined in the chapter dealing with planting, it may be laid down as a general principle that the drier the locality the closer should the plants be spaced. The most effective form of mulching for the reduction of water loss by evaporation is the use of bitumenized paper, because it is impervious to both moisture and air. This material, known as paper mulch, is particularly valuable on soils with low available moisture capacities, since, if unprotected, soils of this type rapidly dry out below their wilting points. The water which collects in the leaves of plants set out in paper mulch reaches the soil under the mulch by way of the openings through which the plants were inserted, but since these openings are almost entirely occupied by the stems of the plants, subsequent escape of this water in the form of vapour is greatly reduced. The commonly held view that maintaining the surface layers of the soil in a fine state of tilth effectively reduces evaporation of soil moisture into the atmosphere has little foundation in fact because, as already pointed out, it has been established that there are very definite limitations on the extent to which the water film covering the soil particles can move *upwards* in a soil. Cultivation helps to conserve the supply of soil moisture which is available to crops only in so far as it destroys competing weed growth. Further than this, cultivation accelerates evaporation of water from the soil down to the depth at which it is carried out, due to the fact that it provides conditions which permit a freer circulation of air. Therefore, in soils possessing an open structure nothing is gained by deep cultivation once the crop has been planted, though a great deal may be lost, not only through increasing the rate of evaporation of moisture from the surface layers, but also by actual destruction of the roots. From the time of planting in the spring until late in the autumn, when hilling up may become desirable, cultivation in pineapple plantations is necessary only for the purpose of destroying weeds, and it should not be carried out to any depth greater than is required to achieve this objective. In this connection, however, it should be pointed out that, under certain conditions, growth of weeds along the inter-row spaces of a pineapple plantation may have a beneficial effect by preventing the soil from becoming excessively wet. Such conditions sometimes obtain during the summer months in the case of the fine-textured, moisture-retentive loams of the Blackall Range. Following soaking rains, adjustments in the moisture relationships of soils of this type occur relatively slowly, with the result that their water content may exceed the field moisture capacity for dangerously long periods unless something is done to accelerate the removal of excess water from the root zone. Increasing the rate of evaporation by deep cultivation is undesirable, even if it were practicable, not only because of the injury to roots which ensues, but also because of the damage which would result from erosion if further heavy rain should fall. Provided weeds are not permitted to encroach within a foot of the pineapple plants, and provided also that they are scythed down at intervals to prevent them from shading the crop, their roots will materially assist in draining soil under the conditions specified while at the same time binding it against the eroding effects of further downpours. On coarser-textured soils, however, pineapple fields should be kept free of weeds at all times and under all circumstances. The occurrence of waterlogged conditions in such soils is indicative of impenetrable substrata or other factors impeding the removal of surplus moisture.

Waterlogging of Soils.

Waterlogging of soils results from one or more of the following conditions:—(1) accumulation of surface water in hollows or depressions, (2) a shallow watertable, and (3) impervious subsoil formations. The harmful effects of waterlogging on plant growth are due to water filling the pore spaces and thus forcing air out of the soil. Under such conditions, roots are literally suffocated as soon as they have used up any oxygen which may have been dissolved in the water. At field capacity, about 50 per cent. of the pore space of a friable loam is filled with water, the remainder containing air; in a clay loam, the proportion of air is usually somewhat less, though much depends on the degree to which a crumb structure has been developed. Since the intolerance of the pineapple for compact clay soils is due to their deficient aeration, especial attention should be given to the drainage of even moderately heavy soils before planting them with this crop. It should be clearly understood, however, that drainage cannot lower the moisture content of a soil below its field capacity, so that in the case of fine-textured soils which lack a crumb structure, aeration may still be deficient even after they have been drained. Temporary waterlogging of relatively coarse textured soils is not uncommon in the pineapple districts of southern Queensland during rainy periods, due to the presence, at a shallow depth, of impervious subsoil formations. It is best to avoid soils of this kind for pineapple culture, but where they must be utilised, great care should be exercised in preparing the land for planting and in laying out the rows. These matters are dealt with in a subsequent chapter.

Water Requirements of the Pineapple.

In the pineapple, as in other green plants, water is taken in through the root system in a continuous stream and given off through the leaves. Any interruption in this flow of water from roots to leaves results in an immediate cessation of growth. Unless a soil is capable of supplying fully the moisture requirements of crops which are grown on it throughout their entire life cycle, maximum yields cannot be obtained. In none of the pineapple districts along the Queensland coast is the rainfall so distributed that the needs of the crop for moisture are fully met at all times of the year. During the rainy season there is a considerable loss of water as run-off, while in the spring and early summer the soil may dry out to such an extent that the supply of moisture becomes the limiting factor for the growth of the crop.

Weather conditions greatly influence the rate at which plants take water from the soil. In the case of the pineapple, growth slows up very rapidly as soon as the mean daily temperature falls below 70 degrees F., so that, in southern Queensland, the water requirements of this crop during the winter months are very much lower than they are during the spring and summer. Other climatic factors which influence the rate at which water is used by plants are rainfall, wind, amount of sunshine, and the humidity of the atmosphere. The amount and distribution of the rainfall chiefly determines the quantity of water which is available for use by the crop at any given time. Irrespective of other factors, pineapples use more water when the moisture content of the soil is near field capacity than when it approaches the wilting point. Wind increases the rate of evaporation of moisture from leaves in the same way as it does from any other damp object.

The amount of water required to produce a given quantity of dry plant material may vary considerably at different times of the year. Most crop plants transpire from 200 to 600 pounds of water for each pound of dry matter produced. At the time the first fruit matures, pineapple plants of the Smooth Cayenne variety contain an average of 84 per cent. of water and 16 per cent. of dry matter, the moisture content of the ripe fruit being approximately the same as that of the plant as a whole. Assuming that pineapple plants transpire an average of 300 pounds of water for each pound of dry matter produced, approximately 1,000 tons of water per acre (equivalent to 10 inches of rain) would be required to produce a 20-ton crop of fruit, excluding that used in the development of roots, stems, and leaves. Allowing for losses due to run-off, evaporation, and percolation, the rainfall in practically all of the pineapple districts along the Queensland coast would be more than adequate to meet this demand were it not for the irregular manner in which it is distributed. As it is, there are few seasons in which the potential yield is not reduced because of an insufficient supply of water during some period of growth. It is evident, therefore, that the moisture relationships of a soil are of the utmost importance in determining its productivity. A high available moisture capacity lengthens the period over which growth may take place and vice versa. Irrespective of the water-holding capacity of a soil, however, maximum utilisation of the available moisture which it contains is achieved only when every possible precaution is taken to prevent loss by evaporation.

SUPPLY OF PLANT NUTRIENTS.

In addition to permitting free circulation of air and the storage of adequate quantities of available moisture, an additional requirement of a soil for pineapple culture is that it shall contain a supply of mineral nutrients sufficient to meet the needs of the crop throughout the whole of its period of growth. Unlike those relating to soil moisture relationships, however, most deficiencies in respect of plant nutrients may be readily corrected by the use of appropriate fertilizing materials. For this reason, a chemically poor soil is not necessarily unsuited for pineapple-growing; in fact, an unfertile soil may sometimes prove a better economic proposition than a fertile one, provided its moisture relationships are satisfactory. For example, most of the soils used for pineapple culture in southern Queensland are deficient in available mineral plant foods as compared with the alluvial soils of the Don and Burdekin deltas in the northern part of the State, but, under existing conditions, they are generally more profitable because of their proximity to canneries and urban fruit markets. Other things being equal, however, the additional cost of fertilizing a poor soil places it at a considerable disadvantage in comparison with a fertile one.

FREEDOM FROM ADVERSE CHEMICAL CONDITIONS.

The third essential requirement of a soil for pineapple culture is that its chemical constitution shall not adversely affect either the growth or the yield of the crop. This implies not only the absence of harmful concentrations of salts, but also a favourable soil reaction. An excessive concentration of soluble salts, such as alkalies, is rarely encountered in soils of regions which are climatically suited to the culture of the pineapple because of the leaching which has taken place in their surface layers. With the exception of the alluvial soils of the Don and Burdekin deltas, all of the soils which are employed for pineapple culture in Queensland have been subjected to a considerable amount of leaching. None of these soils, either leached or alluvial, have been found to contain injurious concentrations of alkali salts, though, in a few, manganese compounds are present in excessive amounts. However, in the case of reaction—that is, the condition of acidity or alkalinity which exists in a soil—a very different position exists. Investigation has shown that, unlike most crop plants, the pineapple thrives best in an acid soil, and that a neutral or alkaline reaction has a depressing effect on growth. In most of the pineapple districts along the Queensland coast the soils are insufficiently acid for the production of satisfactory yields when they are first brought under cultivation and, with a few exceptions, it is necessary to apply corrective treatment prior to planting them with pineapples. Because of the profound influence which soil reaction exerts on the nutrition of the pineapple, particularly with respect to the availability of iron and phosphorus, it is discussed again in greater detail in a subsequent chapter.

[TO BE CONTINUED.]

Fused Needle Disease and its Relation to the Nutrition of Pinus.

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(*Continued from p. 177, February, 1940.*)

IN order to investigate the effects of the presence and absence of organic matter in *Pinus tæda* and *P. caribæa* a series of experiments were designed in 1934 and laid out at Beerwah. The treatment involved the use of organic matter on diseased and healthy trees and, as a comparison, the removal of organic matter from them. The experiments included pot experiments, transplanting experiments, and soil treatments in the field, and will be individually discussed under these headings.

(a) Pot Experiments.

A number of pot experiments were commenced at Beerwah at the forest nursery. For these the plants used were ten-months-old nursery seedlings, averaging 12 to 15 inches in height. The plants were selected from the nursery beds and were chosen as representatives of a diseased and of a healthy series. The treatments applied in the case of *Pinus tæda* were as follows:—

(A) Healthy plants in nursery soil.
(B) Healthy plants in soil from beneath *P. tæda* trees affected with fused needle.
(C) Diseased plants in soil from beneath *P. tæda* trees affected with fused needle.
(D) Diseased plants in soil from beneath *P. tæda* trees affected with fused needle, mixed with one part of cow dung.
(E) Healthy plants in washed white sand (three parts) and cow dung (one part).
(F) Diseased plants in washed white sand (three parts) and cow dung (one part).
(G) Healthy plants in washed white sand.
(H) Diseased plants in washed white sand.
(J) Diseased plants (from the plantations) in own soil (three parts) and cow dung (one part).
(K) Diseased plants (from the plantations) in own soil.
(L) Diseased plants in soil from beneath diseased *P. caribæa*.
(M) Diseased plants in soil from beneath diseased *P. caribæa* and cow dung (one part).
(N) Diseased plants in cow dung.
(O) Healthy plants in cow dung.

The experiment was then repeated using seedlings of *Pinus caribæa* instead of *Pinus tæda*.

Cow dung was used for supplying organic matter owing to its known richness as a mulch for this purpose and the convenience in mixing. The plants used were lifted from the soil and had their roots washed clean with water and were replanted in the appropriate soil treatment. Six plants of each species were used for each treatment, and in this way eighty-four plants of each species were used.

In treatment (N), involving the planting of each species in cow dung alone, only four plants of each were used owing to the fact that no larger number of diseased plants of the requisite age was available.

The results obtained from the experiment were as follows:—

(A) In the first season there was no change, but in the second there was a tendency to twisting and fusion in the second growth period which occurs in the latter half of the summer.

(B) Early and continuous fusion resulted.

(C) No change in the condition of the plants was effected.

(D) There was recovery in the first season, followed by a relapse to the fused condition in the second season.

(E) Good healthy growth occurred in the first season, followed by the onset of disease in the second season.

(F) The plants recovered in the first season but returned to the diseased condition in the second season.

(G) The plants became spindly and chlorotic, with a typical aspect of malnutrition. Little or no growth was made.

(H) Little or no growth occurred. Chlorosis was present.

(J) The plants recovered in the first season but relapsed to fusion in the second.

(K) Continuous production of diseased growth occurred.

(L) No change in the condition of the plants was noted.

(M) The plants recovered in the first season but relapsed during the second.

(N) The plants recovered and made very vigorous growth but reverted to the fused needle condition at the end of the second growing season.

(O) The plants remained healthy and grew vigorously but tended to become fused at the end of the second season.

Similar tendencies as regards response to the various treatments were displayed by *Pinus tæda* and *Pinus caribæa*.

In January, 1937, the trees in each respective pot were given a dressing of half an ounce of equal parts of potassium sulphate, ammonium sulphate, and calcium superphosphate. All plants at that time were virtually in a diseased condition. No responses to the fertilizer were made by any of the plants. This is significant in connexion with the response noted from similar fertilizer trials in the field and will be referred to again in discussing the rôle played by phosphorus.

From this pot experiment it was found that the amount of organic matter when supplied in the form of cow dung was apparently the limiting factor in deciding the condition of the plants in each pot, and that as this organic food supply became exhausted the condition of fused needle appeared. The response of individual trees in each particular experiment varied slightly, but the general direction of the reaction of all the plants in any one treatment was similar. The relapse to the diseased condition shown by the cow-dung-treated plants in the second season after treatment pointed to the fact that a deficiency of fresh organic matter rather than of organic matter *per se,* as there was old material still remaining in the soil, might possibly be the factor causing the change.

(b) Transplanting Experiment.

As a means of investigating the local environmental effect on individual trees it was decided to commence an experiment involving the placing of healthy trees on sites which had produced diseased ones and *vice versa.* Accordingly, a number of three-year-old plantation trees of *Pinus tæda* at Beerwah which were affected with fused needle disease were dug out of the ground and replanted in the holes from which healthy trees had been removed. The healthy trees were not discarded but were planted in the holes from which the diseased trees had been taken. The experiment was initiated in May, 1935, and fifty-four trees, twenty-seven of which were healthy and twenty-seven diseased, were dealt with. The height of the trees varied from 4 to 7 feet. The results obtained from observations made on the trees are shown in Table VII.

TABLE VII.

THE PERCENTAGE OF TRANSPLANTED TREES BECOMING HEALTHY OR DISEASED.

Date.	Healthy, becoming Diseased.	Diseased, becoming Healthy.
21-4-35	..	..
10-2-37	23·0	34·6
20-7-37	20·0	34·5
28-8-38	26·8	26·8
10-7-39	26·8	33·0

It will be seen that a proportion of the previously healthy trees became affected and that some of the formerly affected trees regained their health. The number of healthy trees becoming affected is in excess of the normal plantation increase in the incidence of the disease in the area on which the plot was situated (Table I., Block B). It is infrequently, in the age class to which these trees belonged, that an affected tree regains vigour and retains it. It is, therefore, presumed that the change of site was instrumental in causing at least a proportion of the trees to change their state of health. There is evidence that the site difference is organic rather than mineral in nature.

The fact that all the trees did not change may be explained by means of a possible inherent genetic factor as postulated earlier. In this case the most susceptible trees would be likely to change to the diseased condition, and the fact that there are numerous healthy trees on sites where diseased trees occur points to the fact that all trees are not susceptible to the same degree. If this inherent factor is present it would also explain the comparatively low proportion of diseased trees recovering when planted in the holes where healthy trees had been growing. Only those plants with a relatively low susceptibility, but enough to induce fused needle disease on the site originally occupied, would then be expected to recover.

(c) Soil Treatment in the Field.

Observations made in conjunction with the experiments just described and also in connexion with plantation conditions in general indicated that there was an apparent soil poverty in plant remains suitable for the support of healthy mycorhiza-forming fungi. Normal healthy mycorhizas are found on diseased trees quite frequently, but only in localized patches where there are accumulations of organic matter such as in a decaying piece of wood or around an old stump. It is evident, however, that these few healthy mycorhizas on diseased trees are not present in large enough numbers to appreciably benefit the health of the plant.

In order to test this organic food-supply aspect of the problem still further, a number of soil treatments were carried out. The first experiment (Block K) was laid out in a stand of *Pinus tæda* in the bluegum logging area at Beerwah as a Latin square of five treatments, the respective treatments being as follows:—

(A)—*Clean Chip.*—The soil surface of the plots in this treatment was chipped clear of all vegetation with a hoe and all the chippings were removed, leaving a clean soil surface. The plots were tended whenever necessary in order to maintain the bare condition of the soil, all falling needles and new vegetation being removed.

(B)—*Cover Crop.*—In this treatment the plots were cultivated by digging to a depth of 6 inches with a mattock after removing the cover of vegetation from the surface. The plots were then sown with seed of New Zealand blue lupin (*Lupinus varius*), which was inoculated with an appropriate nitrogen-fixing bacterium, followed by a summer sowing with *Crotalaria goreensis.* Neither crop, however, was a success on this area, probably because of the root competition supplied by the pine trees. Owing to the failure of the legumes in this plot the treatment was then used as an additional replication of (A).

(C)—*Cultivated.*—In this treatment the plots were dug over to a depth of 6 inches and were thereafter kept clean as in (A). The plots were recultivated three times during the ensuing two years, when, following a further advancement in the investigations resulting from another series of experiments, the treatment was used for the purpose of a clean chipped superphosphate trial using a dressing of superphosphate at the rate of 3 cwt. per acre. These plots had become unnecessary for the purpose of the initial experiments, as they had proved by their reaction that they were a duplication of the clean chipped treatments.

(D)—*Control.*—This treatment received routine plantation tending, which in that locality consists of an annual brushing (up to the time when the pines suppress the other vegetation), by means of a brush hook, of all eucalypt and other coppice growth, together with any other vegetation which has in the meantime appeared. The brushed vegetation is left on the ground.

(E)—*Litter Treatment.*—In this case the plots were cleared by grubbing all living vegetation other than the pine trees and then the ground surface was covered with litter. The litter was spread over the surface of the plots, completely covering them to a depth of 5 inches. The litter consisted of leaves and twigs obtained from beneath standing mixed eucalypt forest, together with chipped fresh blady grass (*Imperata* *cylindrica* var. *koenigii*) material obtained from a heavily grassed area on a nearby creek bank. These plots were treated with another dressing amounting to a 3-inch layer over the plot surfaces twelve months after the initial treatment.

The area included in the experiment was 2·5 acres, thus allowing 1 square chain for each plot, including an isolation strip of one row of trees around the border of each plot. The trees had been planted with a spacing of 8 feet by 8 feet and were five years old at the time of treatment. At the age of ten years the trees in the control plots had a mean height of 12 feet as compared with 40 feet on a similar site which supports healthy growth of the same age. There were a number of spaces from which the trees were missing in some of the plots, due to death at some time previous to the initiation of the experiment. This reduced the number of trees in each unit plot to an average of twenty.

The soil is of a poor sandy character which, however, had, before clearing, carried a good vegetational cover in which *Eucalyptus pilularis, E. acmenioides* and *Syncarpia laurifolia* were the dominant species. The individual trees of these species had reached quite a large size. The soil surface had many small bare patches, but there were small shrubs and grassy tussocks growing on it. There was little or no accumulation of a humus layer, the dropped leaves being disposed of rapidly in the prevailing sub-tropical open conditions. The soil type approximates the Glasshouse sands as described by Vallance (1938), but overlies a white marine sand. The age is regarded as being Triassic, and as such the series is thought to belong to the Ipswich Coal Measures.

The location of a plantation on this particular spot was chosen on account of the excellent development of the original eucalypt vegetation, and also because of its good drainage, mechanical character, accessibility, and favourable chemical analysis in comparison with other neighbouring sites. However, the trees planted there became fused and the area proved the worst in the reserve.

In the same year two further but similar plots were initiated, one (Block L) in one-year-old *Pinus caribœa* in the Mellum logging area at Beerwah and the other (Block M) with newly-planted *Pinus tæda* and *Pinus caribœa* at Glasshouse Mountains. In the former case four treatments were used, the cover crop treatment as described in the first experiment being omitted. In the latter case, however, the initial experiment as laid down in Compartment 1, Bluegum, was duplicated. In this block each individual treatment consisted of two rows of *Pinus tæda* and three rows of *Pinus caribœa.*

In the case of the litter treatments, one further application in addition to the previous two was made in the second year in the case of Blocks L and M.

In the case of both blocks, the individual plots consisted of a unit of five rows of five trees each, with an isolation strip of two rows between any two contiguous treatments.

The experiments in Blocks L and M involved young, still healthy trees, and were commenced in order to gain data concerning the effect of the various treatments on the prevention or cause of fused needle disease, and were located on sites which it was thought, by reason of their relative poverty, would be as likely as any to produce a fair proportion of fused-needle-affected stems later.

The soil in the Mellum experiment at Beerwah was of the type described by Vallance (1938) as the Beerwah Sand, and that at Glasshouse Mountains as the Glasshouse Sand. The Mellum plot was located on undulating country, consisting of gentle ridges interspersed by swamps similar to the type described for the Bluegum plot. The Glasshouse plot was placed on a high ridge on soil which overlies a mesozoic sandstone which, in fact, outcrops in places in the experimental area. A considerable amount of fossilized wood is found lying on the surface. The actual citric acid soluble phosphate present in the soil in this Glasshouse plot is the lowest of any of the determinations made on various sites in the vicinity, the reaction being nil as compared with an average of six parts per million for the remainder of the plantation area. It was also noted that the phosphate values for the ridge tops in this locality were consistently less than those determined for the corresponding slopes and gullies.

Both ridges and slopes originally carried a good stand of eucalyptus forest. The Mellum plot, however, did not carry such good original timber as either the Bluegum or Glasshouse areas. It is comparatively low-lying and the swamp vegetation merged into the eucalyptus forest in that neighbourhood.

At the commencement of the experiment in 1935 observations were carried out in the plots, established as described, and thereafter at midsummer and midwinter, when the height and any change in the appearance of the individual trees was recorded. Girth measurements were commenced in 1939, but, owing to the small errors of high significance which are liable to occur in these observations, it is considered that the height measurements are of the greatest importance.

The progress in growth and disease in the three blocks is shown in Tables VIII. to XVII., and is illustrated graphically in Plates 85, 91, 92, and 93, and by photographs in Plates 86-90.

The results of the Bluegum block are typical of those obtained in all three, and will be considered in detail, while those of the Mellum and Glasshouse blocks (L and M) will be referred to only when outstanding differences occur.

In the Bluegum block (Plate 85, Tables VIII., IX., and X.), the height increment in the litter and control plots was similar and the greatest during the first year, the clean chipped treatment was next, whilst the two cultivated plots were the lowest. In the next year the litter treatment gained a decided ascendency over all the other treatments, whilst the control had been reduced to second place and the clean chipped treatment had now descended to fourth place. At this stage a broadcast dressing of superphosphate at the rate of 3 cwt. per acre was applied to treatment (C), which had been cultivated but which was thenceforth only clean chipped. The results for the succeeding year were still in favour of the litter treatment, whilst the fertilizer dressing caused the treated plots to advance to second place, followed very closely by the control (D). The clean chipped treatment had now become definitely last. In the next year, however (1938-39), the fertilizer treatment proved the best, whilst the litter was now similar to the control, which was still significantly superior to the remainder. In total increment from the beginning of the experiment the litter, control, and fertilized treatments were superior to the clean chipped and cultivated, in that order. The actual figures for these observations are to be seen in Table IX.

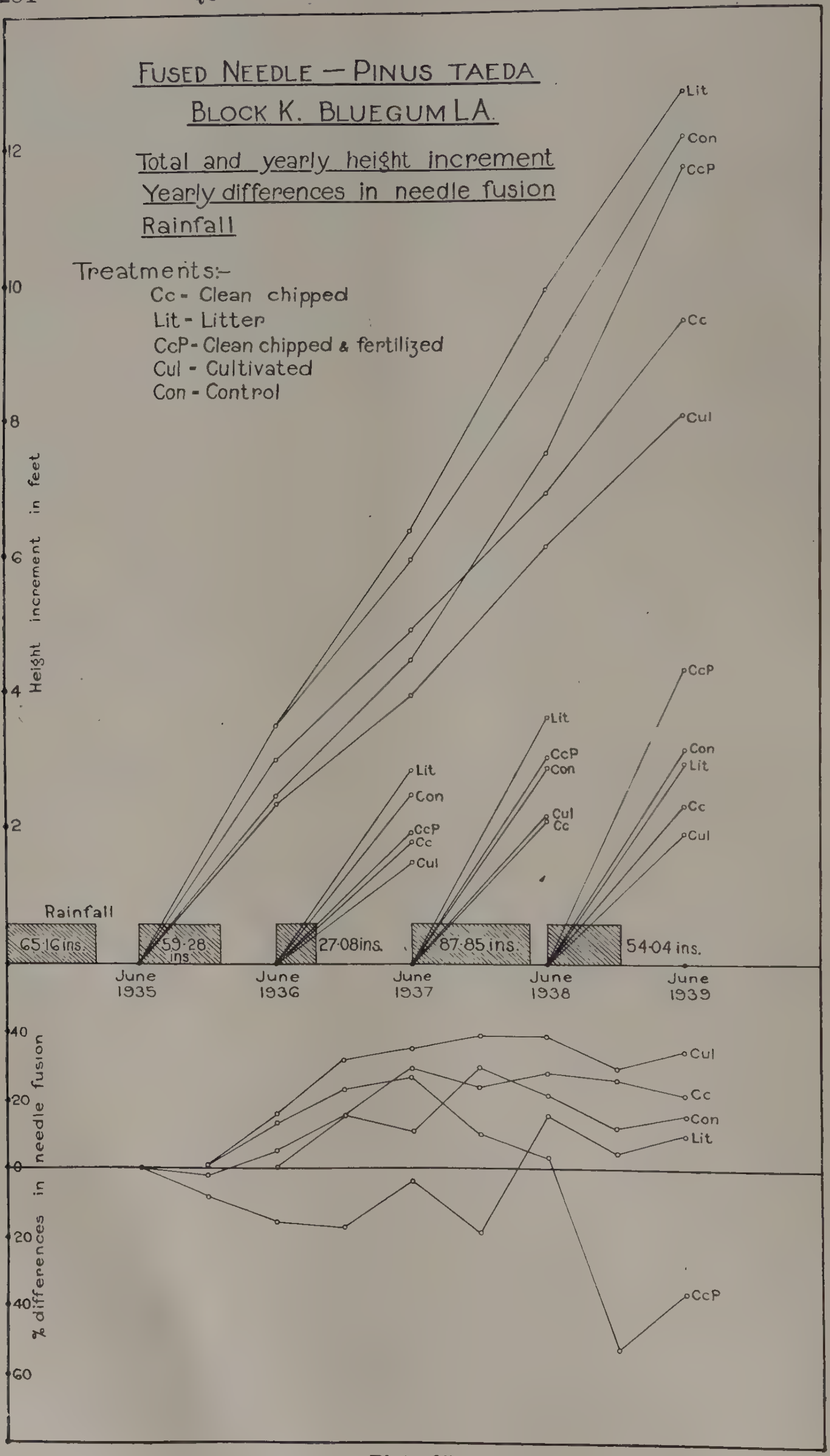
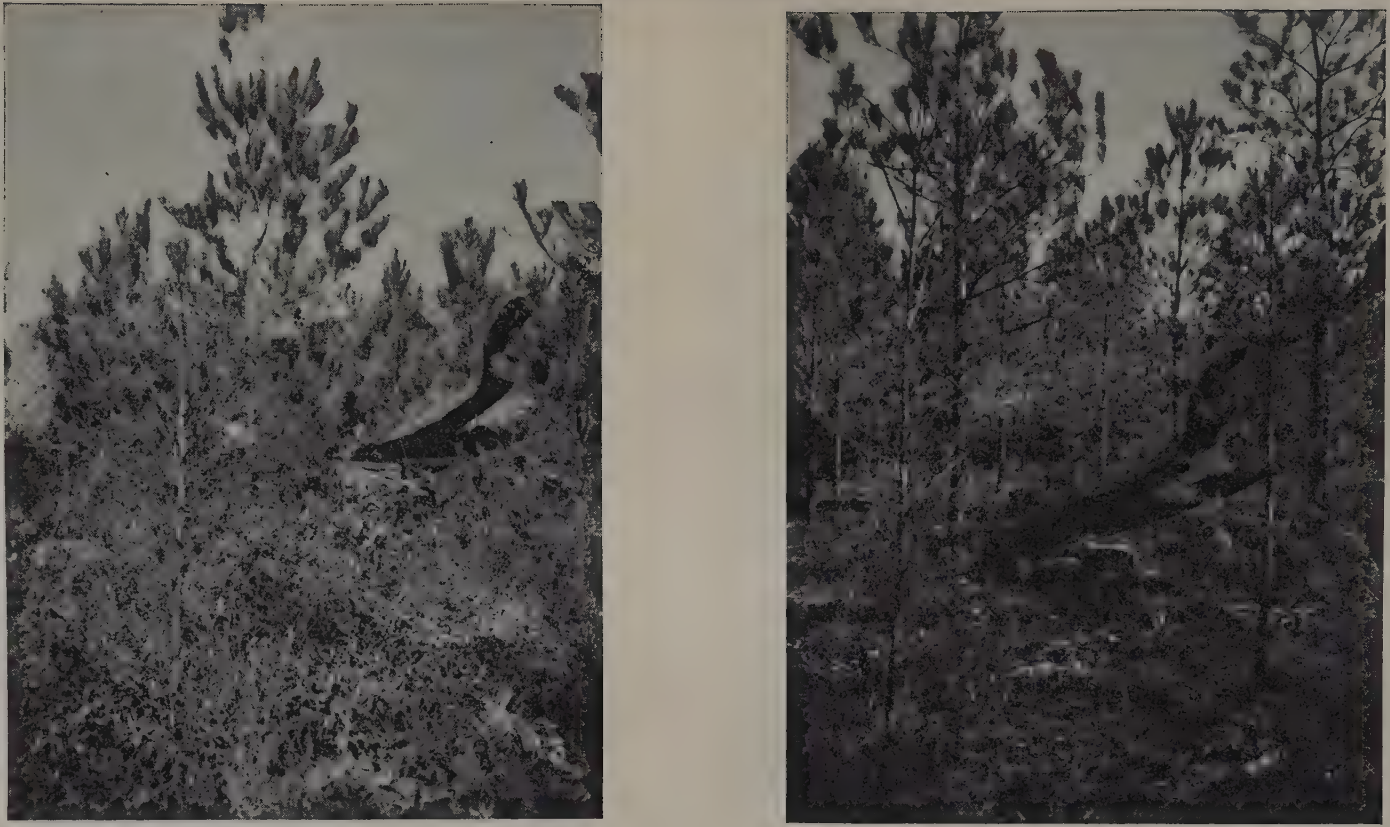


Plate 85.

SOIL ORGANIC MATTER EXPERIMENT, BLOCK K (*Pinus tæda*).—The superphosphate was applied to Plots CcP in June, 1937.



A

B

Plate 86.

Litter and Fertilizer Experiments, Block K (*Pinus tæda*).—Control, untreated plot—Left, 1936; Right, same 1939.

TABLE VIII.

OCCURRENCE OF FUSED NEEDLE IN SOIL TREATMENT EXPERIMENT AT BLUEGUM (BLOCK K).

Treatment.	Percentage Trees Affected with Fused Needle each Season.					
	1934-35.	1935-36.	1936-37.	1937-38.	1939.	1938-39.
(A) Clean chipped	66·0	69·4	96·4	95·4	94·6	92·0
(B) Litter	60·0	42·1	56·8	78·4	69·7	66·3
(C) Cultivated, then clean chipped and fertilized (1937)	67·7	82·3	93·7	63·5	14·5	31·2
(D) Cultivated	57·7	75·0	94·8	97·9	88·5	94·5
(E) Control	62·0	62·0	73·0	88·0	70·0	76·5

TABLE IX.

THE HEIGHT INCREMENT OF *Pinus tœda* IN THE SOIL TREATMENT EXPERIMENT AT BLUEGUM (BLOCK K).

Treatment.	Seasonal Increment, in Feet.						
	1935-36.	1936-37.	1937-38.	1938-39.	Total 1935-37.	Total 1935-38.	Total 1935-39.
(A) Clean chipped ..	1·50	0·94	1·07	1·18	2·44	3·50	4·7
(B) Litter	1·75	1·41	1·80	1·48	3·16	4·96	6·4
(C) Cultivated, then clean chipped and fertilized (1937)	1·24	0·97	1·51	2·14	2·21	3·72	5·86
(D) Cultivated ..	1·21	0·77	1·09	0·94	1·98	3·07	4·0
(E) Control	1·76	1·25	1·45	1·6	3·01	4·46	6·06
Standard error ..	±0·187	±0·198	±0·121	±0·177	±0·253	±0·246	±0·314
Significant difference	0·52	0·55	0·34	0·49	0·70	0·68	0·87
Significant Results ..				C>A,B, D,E C > D			C,B,E > A,D
Results approaching Significance	B, E>D B > C	B > D	B > A, D,E C,E>A,D	B > A,D	B>A,C,D E>D	B>A,C,D E>A,C,D C > D	

TABLE X.

MEAN GIRTH BREAST HIGH IN INCHES IN BLOCK K, AT JUNE, 1939.

Treatment.	Mean Girth.	Girth-Height Relationship. (Height in feet ÷ Girth Breast High in Inches.)
Clean chipped	7·29	7·29 : 12·12 = 1 : 1·6
Cultivated	6·77	6·77 : 11·66 = 1 : 1·7
Cultivated, then clean chipped and fertilized (1937)	8·28	8·28 : 13·35 = 1 : 1·6
Control	8·06	8·06 : 14·1 = 1 : 1·7
Litter	8·89	8·89 : 15·2 = 1 : 1·7

The results obtained in relation to fused needle occurrence are shown in Table VIII. From this table it will be observed that in all plots involving the removal of surface vegetable matter (A, C, and D) there was a steady increase in fused needle disease up to the end of the

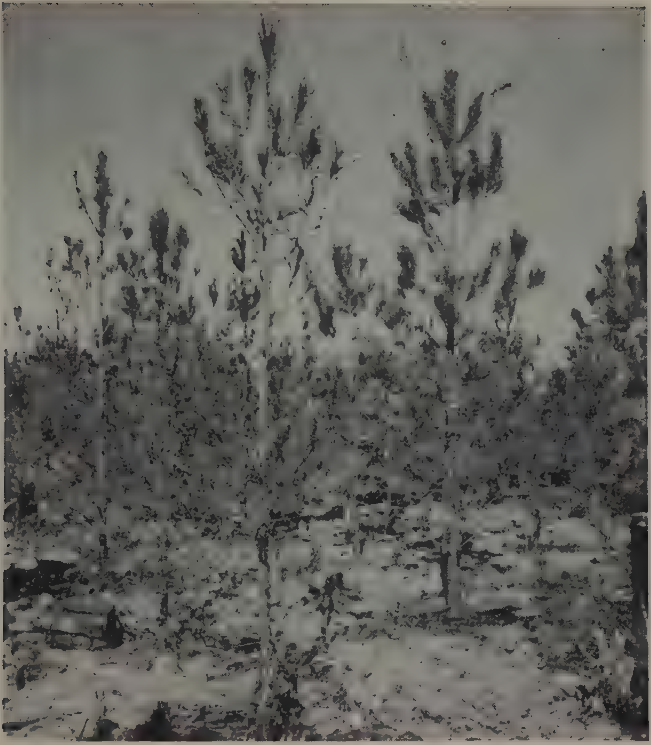


Plate 87.

Litter and Fertilizer Experiments, Block K (*Pinus tæda*).—Fertilized and clean chipped plot 1936, before fertilizing.

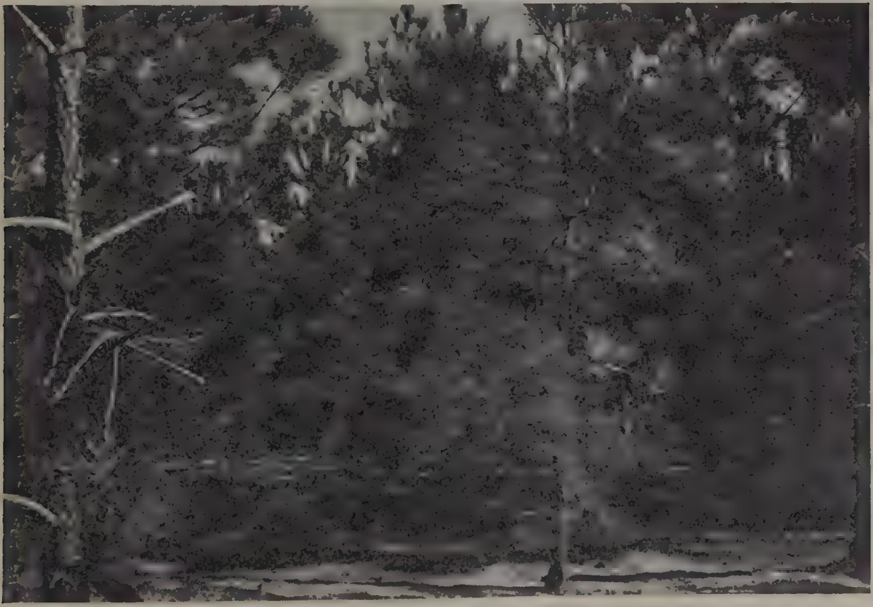
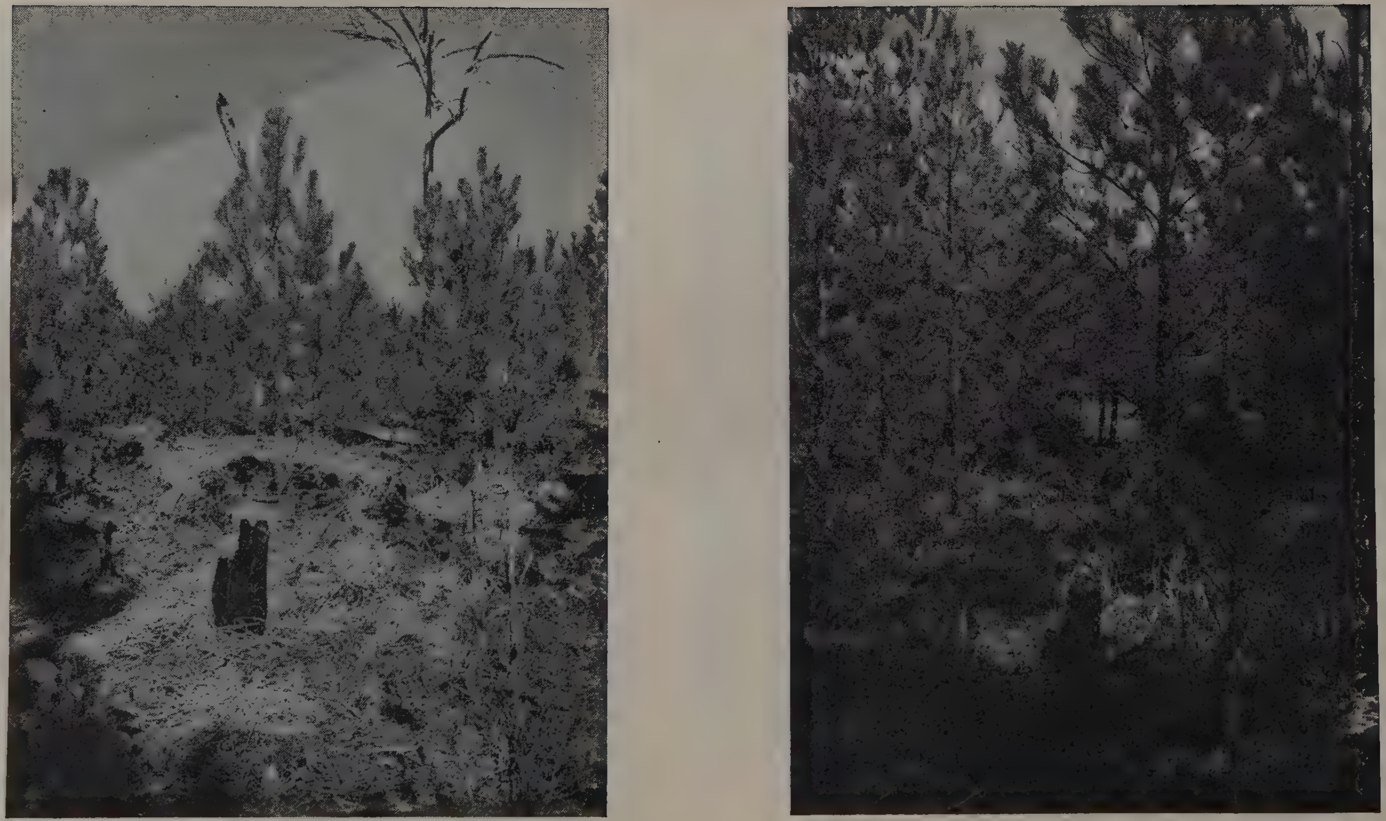


Plate 88.

Litter and Fertilizer Experiments, Block K (*Pinus tæda*).—Fertilized and clean chipped plot, 1939. Same as Plate 87, after fertilizing in 1937.

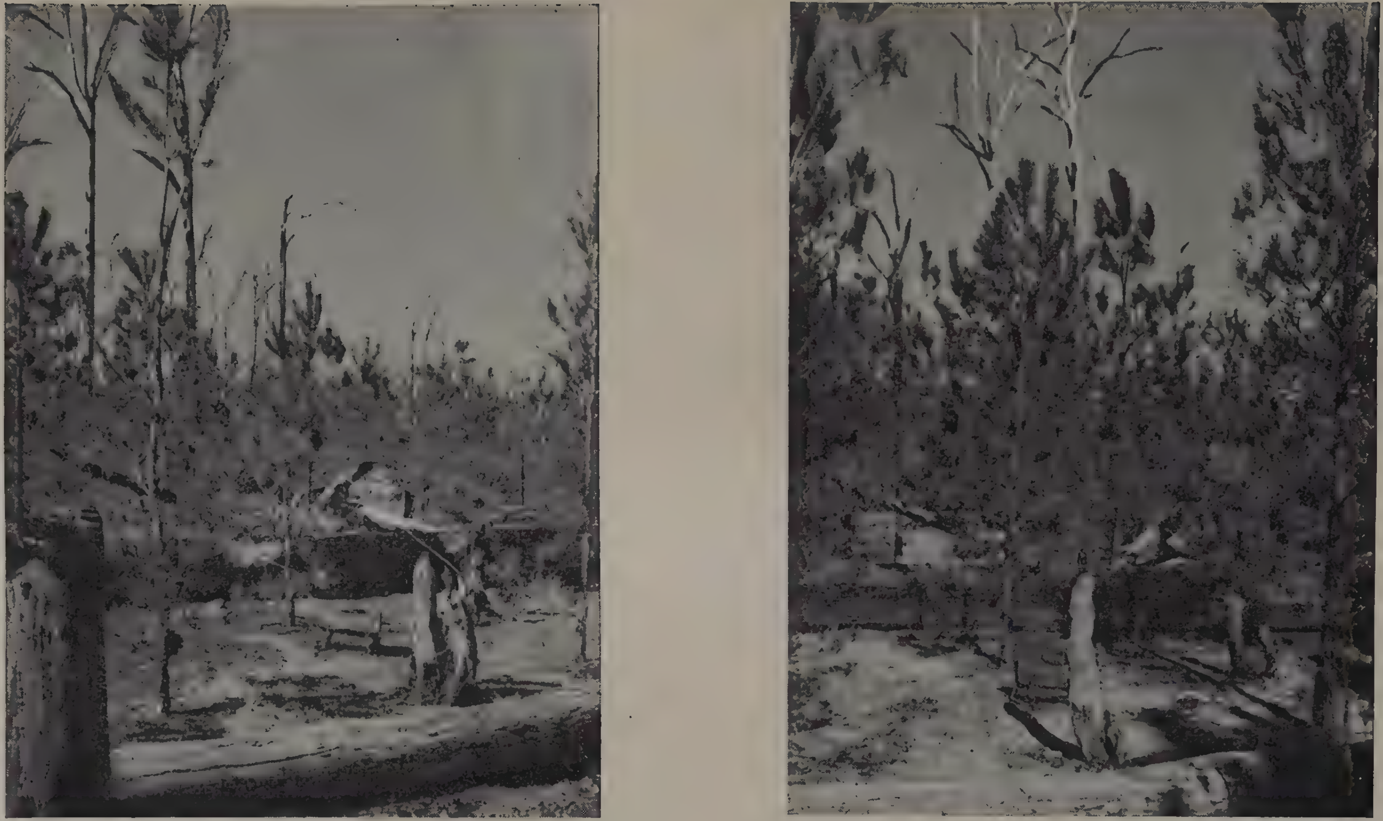


A

B

Plate 89.

LITTER AND FERTILIZER EXPERIMENTS, BLOCK K (*Pinus tæda*).—Litter treatment—Left, 1936; Right, same 1939.



A

B

Plate 90.

Litter and Fertilizer Experiments, Block K (*Pinus tæda*).—Clean chipped plot—Left, 1936; Right, same 1939.

1937-38 season, except in the case of C, which was fertilized and in which a recovery from the typical symptoms was experienced during the growing season following the addition of superphosphate in 1937. The plot treated with litter improved considerably during the first two seasons after initiation, but began to regress towards the condition of the control treatments after that period. The control treatments showed a steady increase in the incidence of the disease, but, as has been illustrated in other plots, began to recover with the gradual formation of a ground cover.

In girth (Table X.) the plots treated with litter are superior to all the others. There is little difference between the control and fertilized plots, which are both superior to the cultivated, which is better than the clean chipped treatment. The girth-height relationship is similar for all plots.

In the case of the Mellum plot (Block L), which was laid out in one-year-old *Pinus caribœa*, the results of the various treatments can conveniently be seen in Plate 91 and Tables XI., XII., and XIII. In this plot the fertilized trees are shorter but stockier than the litter-treated stems. The results from this plot are similar to those from Block K.

TABLE XI.

THE PERCENTAGE OF *Pinus caribœa* TREES AFFECTED WITH FUSED NEEDLE DISEASE EACH SEASON IN BLOCK L, MELLUM.

Treatment.	Season.				
	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.
Clean chipped	..	4·8	14·3	10·0	17·4
Control	..	..	5·5	3·6	9·2
Cultivated, then clean chipped and fertilized (1937)	0·9	2·7	4·5	2·7	2·7
Litter	0·9	1·8	..	2·7	9·0

TABLE XII.

THE HEIGHT INCREMENT IN FEET OF *Pinus caribœa* IN BLOCK L, MELLUM.

Treatment.	Season.				Total Increment, to 30-6-37.	Total Increment, to 30-6-38.	Total Increment, to 30-6-39.
	1935-36.	1936-37.	1937-38.	1938-39.			
(A) Clean chipped ..	0·82	1·35	2·87	3·02	2·17	5·04	8·05
(B) Litter	1·06	1·81	4·13	3·78	2·87	7·00	10·75
(C) Clean chipped and fertilized (1937)	0·75	1·60	4·01	3·95	2·34	6·36	10·28
(D) Control	1·11	1·42	3·06	3·18	2·54	5·60	8·78
Standard Error ±	0·164	0·13	0·12	0·089	0·228	0·335	0·38
Significant Difference (20 : 1)	0·52	0·41	0·38	0·28	0·73	1·06	1·21
Significant Results ..		B > A	C, B > A, D	C, B > A, D		B > A, D C > A	C,B > A,D
Results Approaching Significance ..		B > D			B > A		

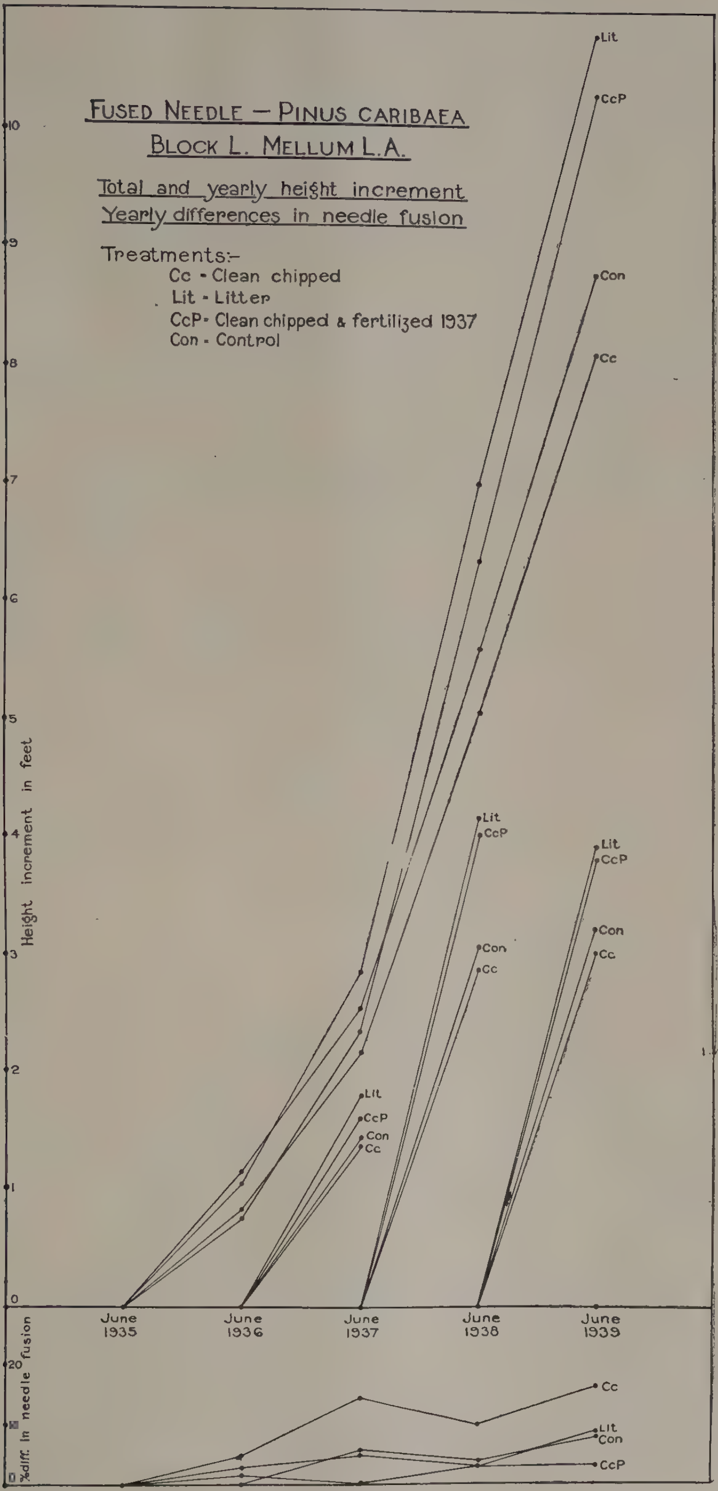


Plate 91.

SOIL ORGANIC MATTER EXPERIMENT, BLOCK L (*Pinus caribæa*).

TABLE XIII.

MEAN GIRTH BREAST HIGH IN INCHES IN BLOCK L, AT JUNE, 1939.

Treatment.	Mean Girth.	Girth-Height Relationship.
Clean chipped	6·05	6·05 : 9·5 = 1 : 1·57
Control	5·76	5·76 : 10·1 = 1 : 1·75
Clean chipped and fertilized (1937) ..	7·81	7·81 : 11·8 = 1 : 1·51
Litter	7·23	7·23 : 12·1 = 1 : 1·67

The results obtained from the Glasshouse Mountains Block (M) are illustrated, in so far as *Pinus tæda* is concerned, in Plates 92 and 93, whilst the actual figures for both species are shown in Tables XIV., XV., XVI., and XVII.

TABLE XIV.

THE PERCENTAGE OF TREES AFFECTED WITH FUSED NEEDLE DISEASE IN *Pinus tæda* AND *P. caribæa* AT GLASSHOUSE MOUNTAINS (BLOCK M).

Treatment.	Season.							
	1935-36.		1936-37.		1937-38.		1938-39.	
	P.t.	*P.c.*	*P.t.*	*P.c.*	*P.t.*	*P.c.*	*P.t.*	*P.c.*
Cover crop	2·0	4·3	8·3	2·9	6·1	3·7	10·6	3·2
Control	8·3	1·3	2·0	2·1	6·25	1·0	4·1	1·2
Clean chipped	4·2	5·5	8·3	2·8	28·5	7·1	22·4	4·2
Litter	4·2	1·4	4·2	1·4	4·2	2·9	6·1	5·8
Clean chipped and fertilized (1937)	9·0	6·6	6·6	2·1	11·0	3·9	2·2	1·2

TABLE XV.

THE HEIGHT INCREMENT IN FEET OF *Pinus tæda* IN BLOCK M AT GLASSHOUSE MOUNTAINS.

Treatment.	Season.				Total Increment, to 1937.	Total Increment, to 1938.	Total Increment, to 1939.
	1935-36.	1936-37.	1937-38.	1938-39.			
(A) Clean chip ..	0·94	1·44	3·81	3·08	2·38	6·19	9·24
(B) Litter	0·83	2·79	5·00	3·38	3·61	8·61	11·66
(C) Cultivated, then clean chipped and fertilized (1937)	0·92	1·91	4·93	3·60	2·83	7·75	11·36
(D) Cover crop ..	0·91	1·94	4·53	3·76	2·86	7·38	11·14
(E) Control	0·74	1·02	3·59	3·36	1·76	5·35	8·72
Standard Error ± ..	0·075	0·301	0·336	0·132	0·378	0·53	0·623
Significant Results ..	0·21	0·84	0·93	0·37	1·04	1·47	1·75
Results Approaching Significance ..		B > E, A D, C > E	B, C > A, E D > E	D > A, B, E C > A	B > A, E C > E	C, B > E, A D > E	A, B, C > A, E

TABLE XVI.

THE HEIGHT INCREMENT OF *Pinus caribœa* IN BLOCK M AT GLASSHOUSE MOUNTAINS.

Treatment.	Season.				Total Increment, to 1937.	Total Increment, to 1938.	Total Increment, to 1939.
	1935-36.	1936-37.	1937-38.	1938-39.			
(A) Clean chip ..	0·79	1·04	3·49	3·24	1·83	5·32	8·56
(B) Litter	0·80	1·73	4·16	3·44	2·53	6·69	10·12
(C) Cultivated, then clean chipped and fertilized (1937)	0·88	1·61	4·61	3·56	2·49	7·09	10·66
(D) Cover crop ..	0·77	1·53	4·13	3·48	2·30	6·43	9·92
(E) Control	0·72	0·77	3·17	3·24	1·49	4·66	7·88
Standard Error ± ..	0·04	0·081	0·180	0·082	0·109	0·267	0·323
Significant Difference	0·11	0·22	0·50	0·23	0·30	0·74	0·90
Significant Results..	C > D, E	B,C,D > E, A A > D	C > E, A D,B > A,E	D,B,C > A,E	D,B,C > E, A A > D	B,D,C > E, A	D,B,C > A,E
Results Approaching Significance ..			C > D				

TABLE XVII.

THE GIRTH AT BREAST HEIGHT OF THE TREES IN BLOCK M (1939) GLASSHOUSE MOUNTAINS.

Treatment.	Girth Breast High.		Girth-Height Relation.	
	P. caribœa.	*P. tœda.*	*P. caribœa.*	*P. tœda.*
(A) Clean chipped	5·55	5·31	1 : 1·7	1 : 1·9
(B) Litter	7·18	7·17	1 : 1·5	1 : 1·7
(C) Cultivated, then clean chipped and fertilized (1937)	6·89	6·89	1 : 1·7	1 : 1·8
(D) Cover crop	6·73	6·72	1 : 1·6	1 : 1·8
(E) Control	4·93	4·71	1 : 1·8	1 : 2·0
Standard Error	0·44	0·508		
Significant Difference ..	1·22	1·41		
Significant Results	B,C > A,E D > E	B,C,D > A,E		

In the case of Block M, the harmful effect of clean chipping is not, from the fused-needle aspect, so evident in the case of *Pinus caribœa* as with *P. tœda.* The percentage of fused needle disease, however, is comparatively low in all plots and the exact relationship, therefore, less evident.

The general direction of the reaction obtained from the various treatments at Mellum and Glasshouse Mountains was the same as that shown by the block at Bluegum. Considering all the blocks together, the litter treatment gave the best results in the early stages regarding the incidence of fused needle disease. As the litter aged, there was a tendency towards an increase of the disease in these plots, and for their place to be taken either by the superphosphate treated plots or by the control plots in which the natural accumulation of litter had begun to play a part. As regards height growth, the litter treatments were outstanding, although in annual increment they tended to be replaced by the superphosphate treated plots in the later years.

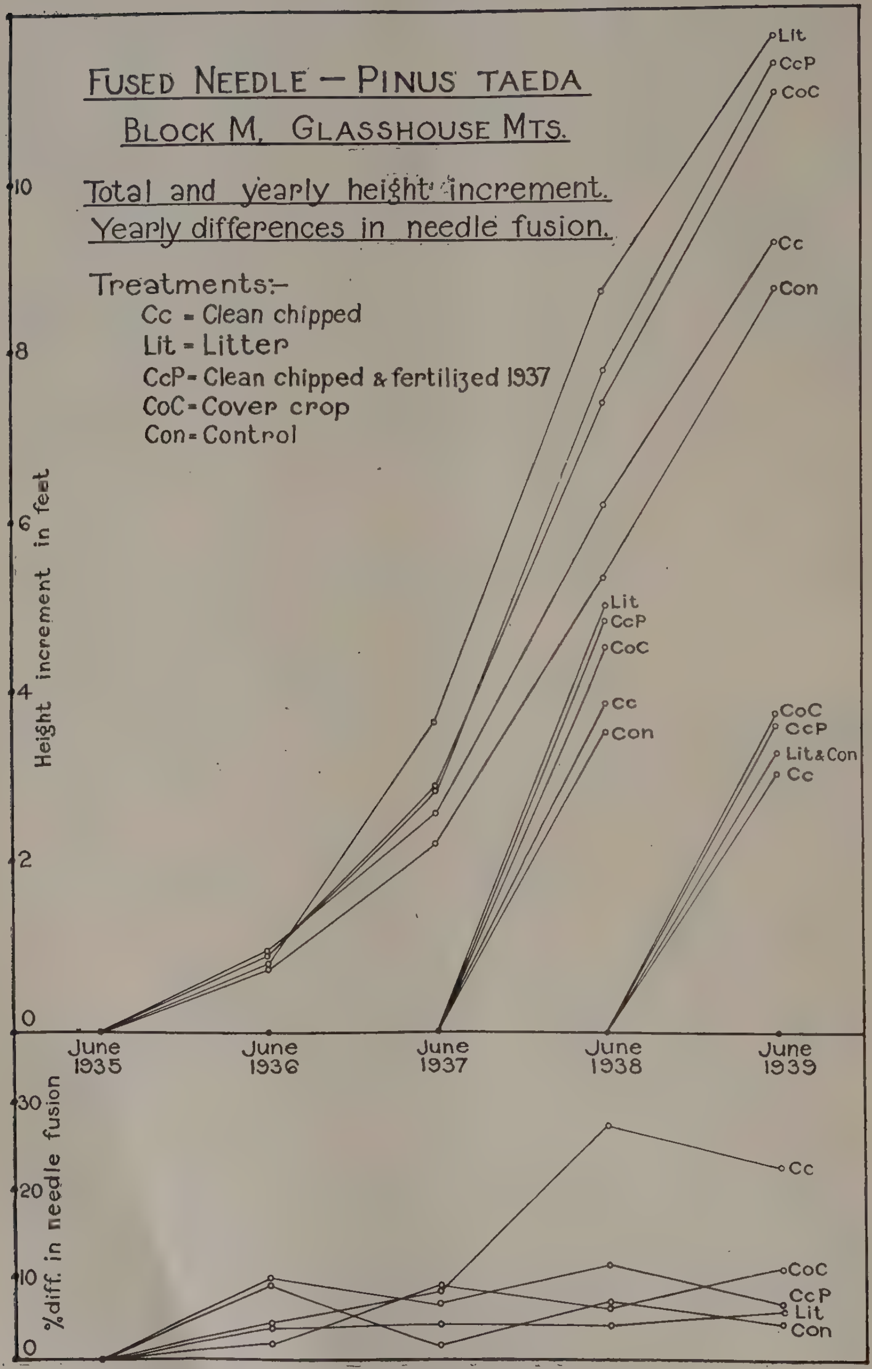


Plate 92

SOIL ORGANIC MATTER EXPERIMENT, BLOCK M (*Pinus tæda*).

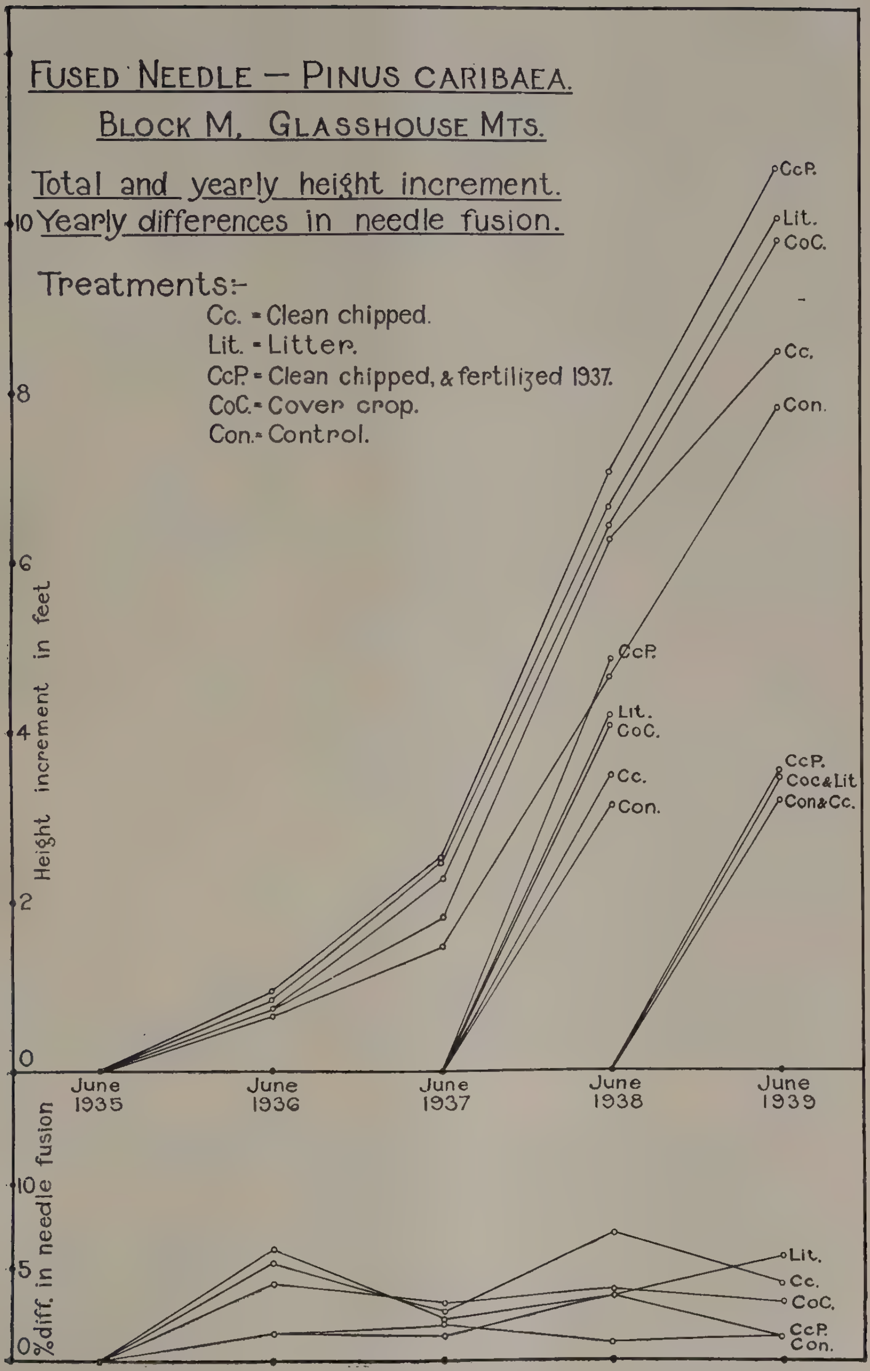


Plate 93.

Soil Organic Matter Experiment, Block M (*Pinus caribæa*).

The cover crop treatment in Block M was sown with the legume *Crotalaria goreensis,* which became satisfactorily established and reproduced itself by self-sowing of seed each year. However, it did not produce any superior reaction to that given by the litter dressing.

The clean chipped plots were consistently the worst as regards fused needle disease, and resembled the control plots in their poor height increments.

Except in the case of Block K, the control plots showed poor height growth throughout. In the case of Block K, the increase in height growth shown by these plots as compared with similar plots in the other experiments is considered to be due to the greater age of the plantation in which Block K is established. This is responsible for a greater natural litter accumulation, with its consequent beneficial effect on the pine growth. The control plots as a whole, however, followed the normal trend in fused needle development in their locality, which usually showed an increase in the early stages and then a decrease as natural litter accumulated.

The result of the application of superphosphate was remarkable. After the initial delay of one season the incidence of fused needle disease rapidly diminished and the annual height increment increased, with the result that the plots thus treated were outstanding in their final appearance.

(d) Delayed Planting.

An experiment was designed at Glasshouse Mountains in order to investigate the effect of natural regeneration of organic litter on pine growth. In the usual course of events in that district the natural forest is felled and burned approximately six months before planting takes place in July. The experimental block was laid out as a Latin square, in which the treatments consisted of planting trees in each respective plot at one, two, three, and four years after the normal planting would have taken place. During the period elapsing between burning and planting, the experimental area was tended in the routine fashion by brushing all vigorous growth and leaving the litter on the ground.

It is hoped by this process that the period of normal plantation susceptibility to fused needle disease will be minimized by the natural recovery evidenced in older plantations. This experiment, however, will not be finalized for some years, and no results of significance are yet available for publication. The area involved in the experiment is 5 acres.

V. SOIL MANURING EXPERIMENTS, WITH SPECIAL REFERENCE TO PHOSPHATE STATUS.

In 1935 it was decided to initiate investigations involving the alteration of the pH value of the soil in which was growing a selected stand of *Pinus tæda.* At the time it was thought that the actual reaction of the soil might be having an adverse effect on the mycorhizal complex of the pine trees, and in this way was perhaps instrumental in bringing about the fused-needle condition. An experiment was, therefore, designed so that some evidence on this aspect of the trouble might be gained, and this, in turn, led to further work on soil treatment.

(a) Broadcast Dressings.

Experiment 1, *Block NA.*—The treatments which it was decided to use were ground limestone, to induce a more alkaline condition, and ground sulphur, to induce a more acid reaction (Young, 1938). An N.P.K. mixture was decided upon for a third treatment, in order to provide a general stimulant for comparison purposes, whilst an untreated control formed the fourth treatment. The experiment was laid out as a randomized block in October, 1935, and was located in Compartment 7, Beerwah, on a site similar to that of the Bluegum experiment described previously.

The dressings which were applied to the respective plots were as follows:—

(1) Ground limestone at the rate of 2 tons per acre.
(2) Control.
(3) N.P.K. at the rate of 5 cwt. per acre.
(4) Ground sulphur at the rate of 6 cwt. per acre.

The mixed fertilizer used consisted of superphosphate 75 lb., ammonium sulphate 25 lb., and potassium sulphate 25 lb. All treatments were applied as broadcast dressings on one-tenth-acre plots, with a two-row isolation strip between the various plots. The annual and progressive increments are shown in the accompanying graph (Plate 94), together with the progress of needle fusion in the various treatments. The actual figures relating to the experiment are to be seen in Tables XVIII., XIX., and XX. Before treatment the pH of the soil was even over the site and ranged from 5·6 to 5·8.

TABLE XVIII.

BLOCK NA—THE INCREMENT IN FEET OF TREES TREATED WITH THE VARIOUS CHEMICALS.

Treatment.	Seasonal Increment.				Total Increment to each Season.		
	1935-36.	1936-37.	1937-38.	1938-39.	30-6-37.	30-6-38.	30-6-39.
(1) Ground limestone	2·7	2·3	4·1	3·3	5·0	9·1	12·4
(2) Control	2·7	2·2	3·9	2·8	4·9	8·8	11·6
(3) N.P.K.	3·1	2·7	5·2	3·9	5·8	11·0	14·9
(4) Ground sulphur	2·9	2·3	4·2	3·3	5·2	9·4	12·7

TABLE XIX.

SUMMARY OF PERIODIC OBSERVATIONS ON FUSED NEEDLE DISEASE IN BLOCK NA, BLUEGUM.

Treatment.	Total No. of Trees.	Percentage of Trees Affected each Year.					pH 1938.
		1935.	1936.	1937.	1938.	1939.	
(1) Ground limestone	116	21·6	35·4	49·25	55·1	44·8	6·1
(2) Control	123	23·5	37·4	46·4	48·75	40·6	5·7
(3) N.P.K.	121	14·9	24·8	18·2	Nil	Nil	5·4
(4) Ground sulphur	123	23·5	38·25	56·9	51·25	56·1	5·0

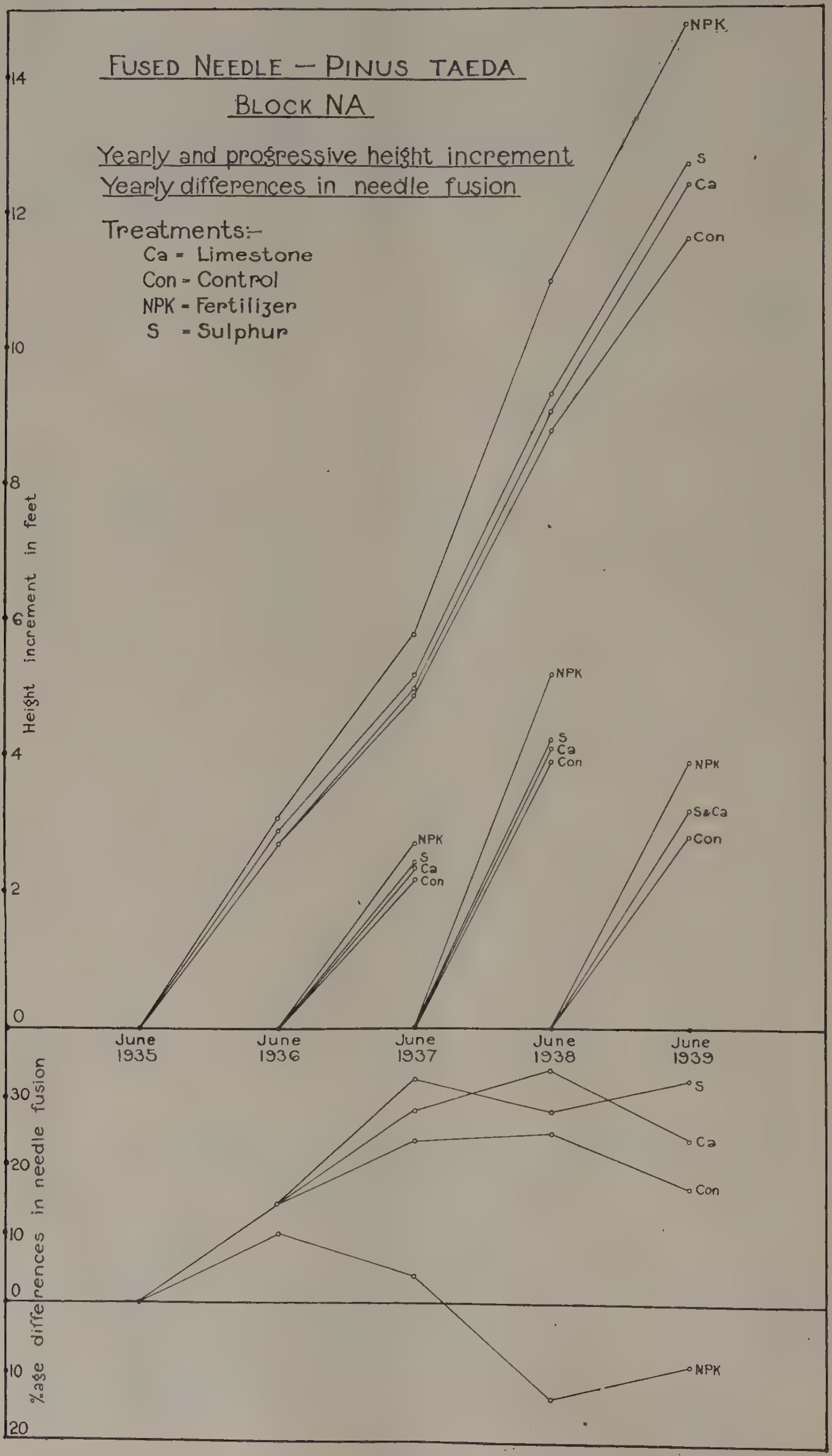


Plate 94.

SOIL MANURING EXPERIMENT, BLOCK NA (*Pinus tæda*).

TABLE XX.

MEAN GIRTH BREAST HIGH OF TREATMENTS IN BLOCK NA, BLUEGUM (1939).

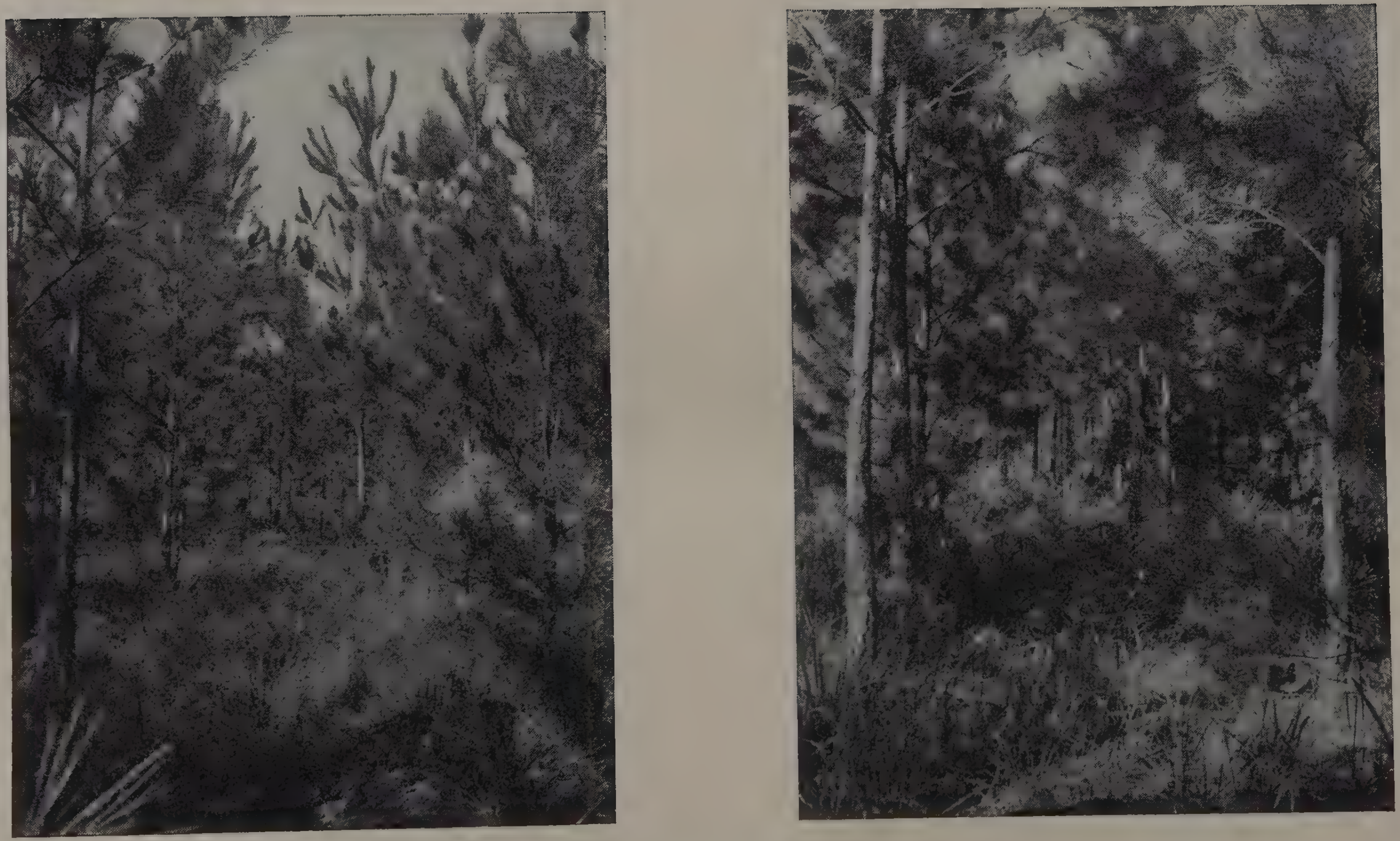
Treatment.	Girth in Inches.	Girth-Height Relationship.	
		Mean Height.	Relationship to Girth.
(1) Ground limestone	10·83	19·4	1 : 1·8
(2) Control	10·46	18·6	1 : 1·8
(3) N.P.K.	12·58	22·0	1 : 1·8
(4) Ground sulphur	10·88	20·1	1 : 1·86

From the results given it will be seen that during the first two years after the initiation of the experiment there was no marked difference in height growth between any of the treatments. A uniformity examination before treatment also showed that the plots were directly comparable. In the seasons 1937-38 and 1938-39 the N.P.K. treated plots made outstanding progress, the appearance of the trees also considerably improved, the crowns becoming heavily covered with dark-green healthy foliage. In all the other treated plots there was a parallel development to that shown by the controls except during the last season, when the limestone and sulphur plots improved. The N.P.K. plots were also outstanding when the incidence of fused needle disease was considered, the amount of disease being reduced to zero in 1937-38 and remained absent in 1938-39, whilst the trouble in all the other plots had shown a normal increase until the 1937-38 season. During the 1938-39 season, however, the limestone and control plots improved.

In the Table (XX.), showing the results of girth measurements, it will be noted that the N.P.K. treatment is superior in that respect to all the others. The limestone and sulphur treatment results are approximately equal and the results for the control are the worst. The girth-height relationship is similar for all the treatments.

A very notable feature of the response provided by the plots treated with the N.P.K. mixture was the remarkable reaction experienced by the natural vegetational ground cover, which consisted of grass, heaths, and eucalypt coppice. At the time of application of the fertilizer the ground had numerous bare patches of soil surface interspersed with tussocks of grass and with shrubs. The description supplied for the soil treatment site at Bluegum (Block K) fits this area admirably. In the first season after fertilizing the grasses began to spread, and in the second a complete luxuriant ground cover was established and has persisted except where it is now being killed out by the formation of a canopy by the pine trees and where a needle litter is now taking its place. The other treatments produced no observable effects on the ground cover or the trees. The effect of superphosphate treatment is illustrated photographically in Plate 95.

In the N.P.K. treatment it is considered that the stimulation of the ground cover was largely responsible for the beneficial effects on pine growth. This conclusion was arrived at, firstly, because direct application of litter, as was done in previously described experiments, has been followed by a similar response, and, secondly, because the fertilizer effect was produced after a distinct time lag (almost two



A

B

Plate 95.

Fertilizer Experiments, Block NA (*Pinus tæda*), 1939.—Left, untreated control plot; Right, fertilized plot (N.P.K.).

Plate 96.

FERTILIZER EXPERIMENTS, BLOCK NB (*Pinus tæda*), 1939.—Ammonium sulphate treated plot.

years) and made its appearance with the production of an efficient ground cover. It was also considered that the effect was most probably due to the superphosphate contained in the mixture on account of the fact that the phosphorus was the most likely constituent to be bound in the soil over the period in question and also because analyses had demonstrated the presence of adequate supplies of nitrogen and potassium in the soils. For this reason superphosphate alone was applied to the cultivated plots in the previously discussed experiments at Bluegum, Mellum, and Glasshouse Mountains, while further experiments using all the N.P.K mixture ingredients were initiated on fresh sites. The unsatisfactory results obtained from single-tree soil treatments with superphosphate (Young, 1935; Ludbrook, 1939) is also considered to be due to this effect. With single-tree treatment there is not enough soil area involved to be able to bring about any effective change in the tree-root environment by the stimulation of litter formation.

Experiment 2, *Block NB.*—In order to verify the results obtained from the first experiment, it was duplicated in 1935 on adjacent ground one year after the initiation of the first trial. Two additional treatments were added to the layout—namely, ammonium sulphate and potassium sulphate used at the same rate as in the N.P.K. mixture. The results obtained from this experiment (Block NB) are shown in Tables XXI. and XXII., and Plates 96 and 97.

TABLE XXI.

THE INCREMENT IN FEET AND THE FUSED NEEDLE POSITION IN BLOCK NB.

Treatment.	Inc. for 1937-38.	Inc. for 1938-39.	No. of Trees.	Percentage of Trees Diseased.			
				1935-36.	1936-37.	1937-38.	1938-3.9
(1) Ground limestone	4·15	3·35	116	10·35	29·4	39·75	23·7
(2) Control	4·15	3·2	108	20·4	34·25	34·25	35·5
(3) N.P.K.	4·9	3·9	113	20·3	15·9	15·9	1·0
(4) Ground sulphur	4·7	3·15	111	9·0	27·0	37·0	36·9
(5) Ammonium sulphate	4·11	2·7	108	..	32·4	43·6	67·6
(6) Potassium sulphate	4·2	3·66	119	..	26·8	37·8	30·25

TABLE XXII.

THE MEAN GIRTH AT BREAST HEIGHT OF THE TREES IN EXPERIMENT NB, AT JUNE, 1939.

Treatment.	Girth Breast High in Inches.	Mean Height.	Girth-Height Relationship.
(1) Ground limestone	11·39	20·3	1·78
(2) Control	11·63	20·8	1·79
(3) N.P.K.	12·44	21·6	1·74
(4) Ground sulphur	12·07	21·6	1·78
(5) Ammonium sulphate	10·54	18·75	1·78
(6) Potassium sulphate	11·74	22·3	1·9

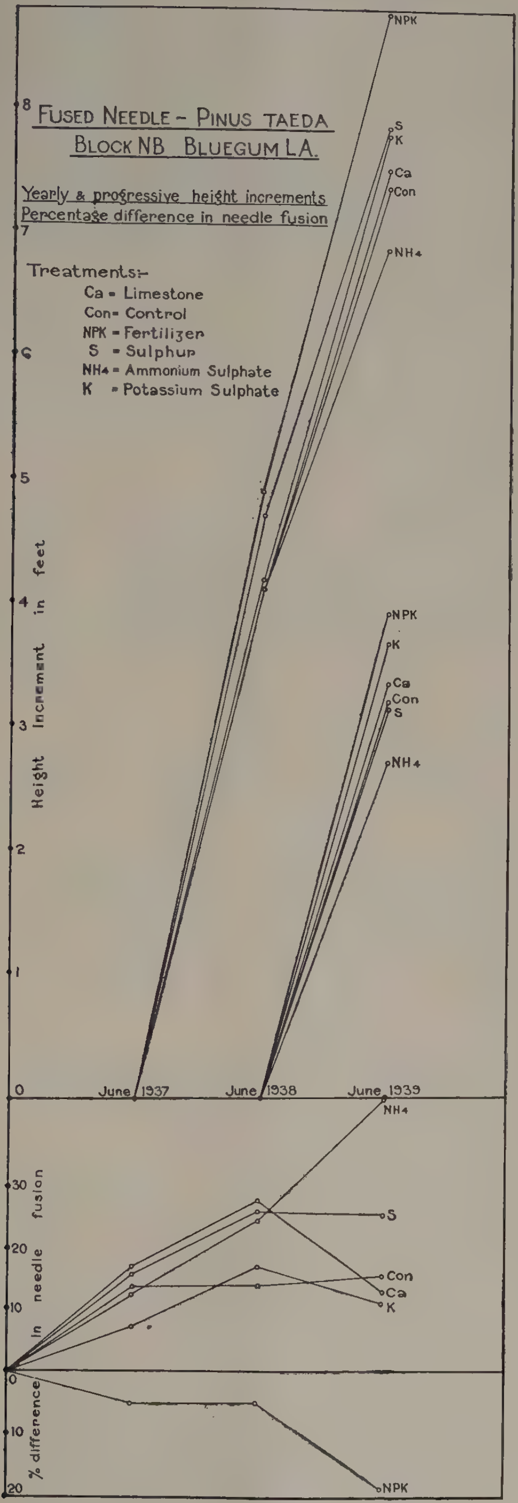


Plate 97.

SOIL MANURING EXPERIMENT, BLOCK NB (*Pinus taeda*).

It will be noted that a similar progression to that shown by the initial plot has taken place. The N.P.K. mixture again gave the best results as regards both growth and health, and it will be noted that the disease incidence had almost been removed in the plots so treated. There is also seen to be a decrease in disease in the limestone treatment during the last season and a slight decrease in the potassium treatment. The ammonium sulphate treatment showed a definite repressive effect on tree growth, and also caused a large incidence of fused needle disease. The control plot showed a slight increase in fused needle, but no relative decrease in height growth. In mean girth (Table XXII.), the N.P.K. treated plots were again best, followed by the sulphur, potash, control, limestone, and ammonium sulphate treatments in that order. The ammonium sulphate in this connexion also showed a definite repressive effect. The results obtained with the superphosphate dressings with removal of litter by chipping and raking in the Bluegum, Mellum, and Glasshouse Mountains plots indicate that the response to the fertilizer was bound up with this constituent of the mixture.

Experiment 3, *Blocks NC and ND.*—For the purpose of further investigations into this phase of the experiments, another and third series of fertilizer trials were commenced in August, 1937. The plots were in *Pinus tæda* (Block NC) and *Pinus caribæa* (Block ND). The site used for Block NC was comparable to the two previous ones, and the trees were of the same age, whereas Block ND was situated on a swamp with a fine sandy soil and this appears to have had a definite influence on the results.

In the case of the *Pinus tæda* (Block NC), the treatments applied were:—

(1) Litter, together with superphosphate at the rate of 3 cwt. per acre. The litter application was to a depth of 3 inches.

(2) N.P.K. at the rate of 5 cwt. per acre, mixed in similar proportions as in the previous experiments (NA and NB).

(3) Litter, 3 inches deep on the soil surface.

(4) Superphosphate at the rate of 3 cwt. per acre.

(5) Control.

(6) Ammonium sulphate, at the rate of 1 cwt. per acre, treated annually in the spring.

The experiment commenced in *Pinus caribæa* (Block ND) was similar; in this case the ammonium sulphate treatment was omitted.

The layout was a randomized block with two replications as in the previous experiment, and the individual units in the two experiments were arranged as one-tenth-acre blocks with isolation strips between them. The treatments applied were designed to compare the results of the various favourable treatments already given, and it was also decided to again include an inorganic nitrogenous fertilizer in Block NC for comparison with the litter treatment and the mixed fertilizer. In this case ammonium sulphate was used again. Good results had been achieved in previous tests with both litter, superphosphate, and N.P.K. dressings. In the last case, the indications were that the phosphate alone was the active ingredient for the purpose of this investigation. In the experiment under consideration litter, superphosphate, and N.P.K. were directly compared with each other, whilst the application of litter and superphosphate together, to the same plot, was also carried out in order to see if the effects of the two dressings were complementary.

Observations made at the conclusion of the first year after treatment showed that there was no significant difference in the height increment of any of the treatments, although the general appearance of the plots which included superphosphate in their dressings was superior to that of those which did not receive this ingredient. The ground cover of the phosphate treated plots and the density of foliage on the trees had improved very noticeably during the first season and was very satisfactory during the second season. The results illustrating the effects of the different treatments on the incidence of fused needle disease are shown in Tables XXIII. to XXVI. and Plates 98 and 99.

TABLE XXIII.

The Height Increment in Feet and Fused Needle Percentage in Block NC in *Pinus tæda.*

Treatment.	No. of Trees per Plot.	Percentage of Trees Affected.			Height Increment, 1937-38.	Height Increment, 1938-39.
		1936-37.	1937-38.	1938-39.		
(1) Litter and superphosphate ..	125	52·0	16·8	2·4	4·39	4·3
(2) N.P.K.	127	44·9	36·25	7·0	4·92	3·9
(3) Litter	121	44·75	36·4	18·1	4·43	3·55
(4) Superphosphate	127	43·3	26·75	2·4	4·64	4·0
(5) Control	124	33·9	42·75	40·3	4·15	3·0
(6) Ammonium sulphate ..	120	40·0	62·5	62·4	..	2·75

No results were obtained for the height increment of treatment No. 6 in Block NC in 1938 owing to the fact that growth had already commenced in the trees receiving this dressing at the time of measuring, and consequently no authentic measurements could be taken for that season's initial height.

TABLE XXIV.

The Mean Girth Breast High in Inches of the Trees in Block NC, in *Pinus tæda.*

Treatment.	Girth Breast High.	Mean Height, in Feet.	Girth-Height Relationship.
(1) Litter and superphosphate ..	11·41	21·2	1 : 8
(2) N.P.K.	11·83	21·8	1 : 8
(3) Litter	11·90	22·7	1 : 9
(4) Superphosphate	12·15	22·0	1 : 8
(5) Control	10·64	19·6	1 : 8
(6) Ammonium sulphate	10·53	20·3	1 : 9

The figures given for height increment illustrate the fact that the response expected from superphosphate dressings was given to some extent by all the trees so treated during the first season and was more marked in 1939. There was also a response to the litter treatment

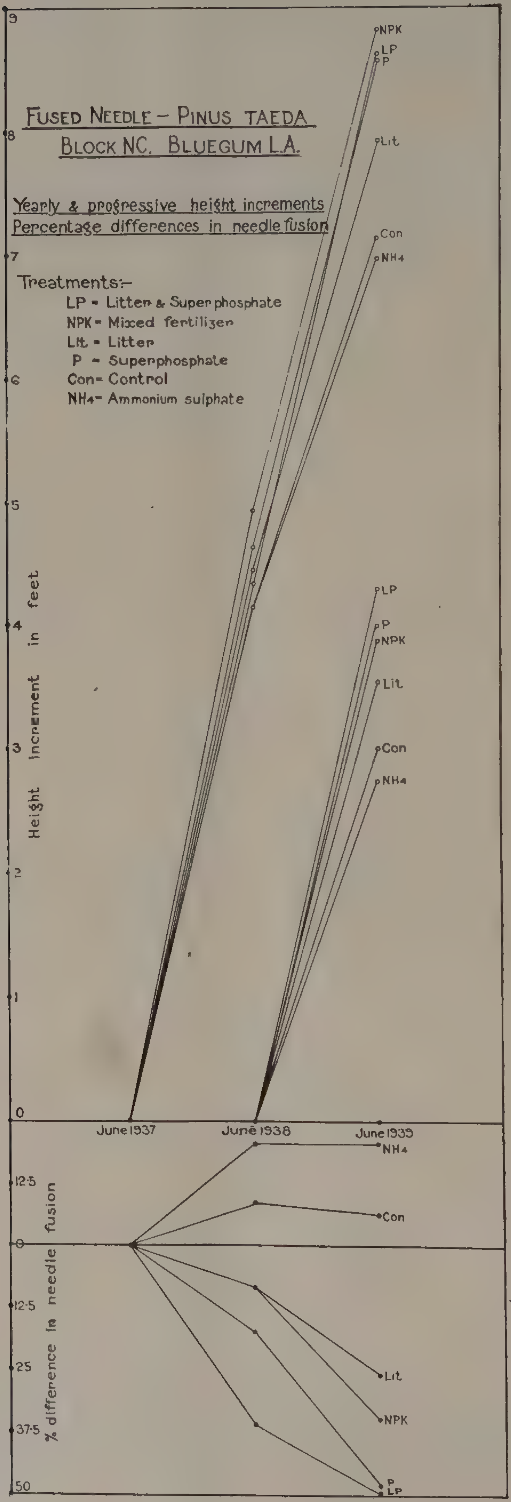


Plate 98.

SOIL MANURING EXPERIMENT, BLOCK NC (*Pinus tæda*).

alone. The most significant reaction was the decline of fused needle disease in some of the treatments, and at midsummer in the current season (1938-39) the results were very marked. The only trees showing little difference were those in the control. The ammonium sulphate treatments again produced a decreased height growth and increased fused needle disease. Both the combination litter-superphosphate treatment and the superphosphate dressing alone had reduced the disease incidence remarkably, and the reduction in the two cases was similar. The litter-superphosphate mixture, however, produced the best growth in both plots. A reduction in the number of diseased trees was also experienced by the plots treated with N.P.K., with and without litter, though in Block NC by no means to the same extent as in the two previously noted treatments. In Block ND the litter application increased the amount of fused needle disease. This is no doubt due to the abnormal soil conditions in the swampy site, and will be discussed more fully in Part B.

The great and abnormal increase in disease in the ammonium sulphate treated plot, as compared with the control, is remarkable. There was no noticeable increase in ground cover on this treatment, and a somewhat similar effect, though to a lesser extent, was noted with the same treatment in Block NB, as discussed previously. It is considered that the ammonium sulphate in the N.P.K. mixture is responsible for the superiority of the superphosphate alone, as compared with the mixture. Equal quantities of phosphate were applied in all cases. It is possible that the bad effect of the ammonium sulphate is due to the quicker disappearance of the organic matter resulting from increased activity of cellulose-destroying organisms.

The mean girths breast-high of the trees in the various treatments approximately follow the trends in height increment and health, with the ammonium sulphate treatment the worst and the superphosphate the best. The girth-height ratio is approximately equal for all plots.

TABLE XXV.

THE HEIGHT INCREMENT IN FEET AND THE AMOUNT OF FUSED NEEDLE DISEASE IN BLOCK ND IN *Pinus caribæa.*

Treatment.	No. of Trees per Plot.	Percentage of Trees Affected.			Height Increment, 1937-38.	Height Increment, 1938-39.
		1936-37.	1937-38.	1938-39.		
(1) Litter and superphosphate ..	104	18·35	19·28	1·0	4·04	4·21
(2) N.P.K.	116	16·4	18·95	4·3	4·24	4·08
(3) Litter	98	7·14	37·8	52·0	3·86	3·76
(4) Superphosphate	113	13·28	18·6	2·6	4·34	4·46
(5) Control	120	8·7	30·0	41·6	3·84	3·59

It will be seen that *Pinus caribæa* has behaved in a similar fashion to *Pinus tæda* in that a marked fused needle and height growth response was provided by all the areas treated with superphosphate in any form.

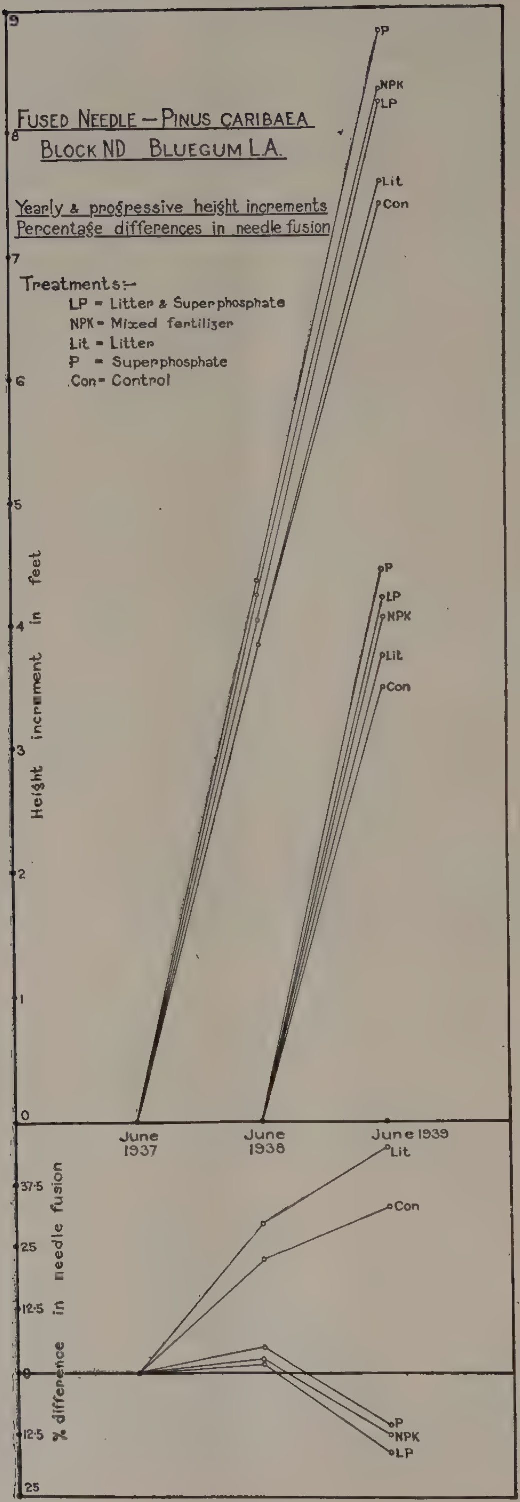


Plate 99.

SOIL MANURING EXPERIMENT, BLOCK ND (*Pinus caribæa*).

TABLE XXVI.

THE GIRTH AT BREAST HEIGHT IN PLOT ND (1939) IN *P. caribœa.*

Treatment.	Girth Breast High.	Mean Height.	Girth-Height Relationship.
(1) Litter and superphosphate ..	8·88	16·0	1·8
(2) N.P.K.	9·32	16·4	1·8
(3) Litter	8·62	16·1	1·8
(4) Superphosphate	9·51	17·2	1·8
(5) Control	9·24	16·7	1·8

(b) Total Phosphate Requirements.

Following the results obtained by measurements and observations carried out on the various experimental plots, analyses for phosphate content were made on samples collected (June, 1939) from each unit plot of each treatment. The analyses were carried out by the Agricultural Chemist. In all 111 such analyses were made. It was found that in nearly every case all the phosphate applied as superphosphate had become fixed in the soil and that there was no phosphate available as shown by the citric acid soluble method. The sampling over the plots was carried out to a depth of 4 inches. By another series of analyses it was shown that all the phosphate added, which in each case was 3 cwt. per acre, was fixed in the top 2 inches of the soil. The mean amount of phosphate in the top 4 inches of soil in all the untreated plots was 83 parts per million. In the treated plots it was 190 p.p.m. In the latter cases all plots were showing healthy growth and in the former abnormal growth. Where phosphate had been applied and the soil undisturbed, as in the experimental plots, the phosphate was normal for the area (83 p.p.m.) below the 4-inch level in which the fertilizer was concentrated. The effect of cultivation on such a site would be to distribute the phosphate through the disturbed area and thus lower its concentration. In the top 8 inches of soil to which 3 cwt. of superphosphate per acre had been applied, the actual phosphate content was 120 p.p.m., although in the top 4 inches it was 190 p.p.m. and in the top 2 inches 330 p.p.m. A simple calculation shows that all the phosphate was apparently fixed in this latter region. On the site of an old pineapple farm, where fused needle disease does occur, but very infrequently. there is total phosphate present to the extent of 135 p.p.m. This was in the same concentration throughout the top 8 inches of soil, where it had probably been well distributed by ploughing operations. In areas receiving superphosphate as a surface dressing, fused needle disease has entirely disappeared, as is illustrated in the foregoing experiments, whereas, where cultivation and consequent dilution of the phosphate has occurred, there is still fusion present, although the actual phosphate content, to a depth of 8 inches, is greater. The surface feeding habit of the root system of the pine trees is important in this regard. The mycorhizal roots are concentrated in the top few inches of soil, and it seems that the actual concentration of phosphate in that region alone, rather than to a lower depth, is the limiting factor involved.

Analyses were also made of the needles from each of the plots. In all cases only the newest needles were used so as to ensure that they were the same age. From untreated soil where the mean phosphate content was 83 p.p.m. the mean needle content (dry weight) was 1,300 p.p.m. From fertilized soils with a phosphate content of 190 p.p.m. in the top 4 inches, the needle content on the average was 2,400 p.p.m. It will therefore be seen that the amount present in the soil is directly reflected by the content of the new needles when there is a deficiency. In areas where there is abundant phosphate present, however, the needle content does not exceed the amount quoted, which appears to be the maximum amount of phosphate absorbed.

The phosphate content of the litter cast by the natural vegetation on unfertilized poor sites at Beerwah has a mean value of 350 p.p.m., on fertilized sites the mean value is 730 p.p.m. Similar values were obtained from analyses made of freshly cast needles of pine trees on the same sites. The fact that the amount of phosphate in the normal litter is considerably higher than that in the normal soil (83 p.p.m.) in part explains the beneficial effect of litter applications but does not explain why litter treated trees tend to become badly diseased again as the litter ages. If it were a simple phosphate effect this would not happen, since the phosphate, except that retained in the wood, is being returned to the soil surface.

The experiments described, which involved the treatment of some plots with litter as well as phosphate, indicated that this treatment. except on swamp (raw humus) sites, gave a better response than the phosphate alone. The function of the litter is more fully discussed in Part B, but in brief it is considered that in its raw state it provides a source of carbon and other organic materials essential for both the mycorhizas and the pine tree itself. After ageing it loses a great deal of value in this regard. The satisfactory functioning of the mycorhizas, however, is apparently intimately bound up with the amount of total phosphate present in the soil also.

The little response obtained from superphosphate application at the rate of 3 cwt. per acre on swamp sites (Block ND) is explainable because of their abnormally low initial phosphate value. On these sites the soil is a fine grey sand with total phosphate values of from 10 to 27 p.p.m. Such sites as these would require considerably greater additions of fertilizer to bring them up to a value greater than the minimum requirement for healthy pine growth.

(c) Conclusion.

In many respects the results of the soil treatment experiments have been outstanding. The retrogression shown by the pine trees growing in soil which was kept clean chipped and raked, throughout the period of the experiments was noteworthy. When superphosphate was added to such plots the treatment caused a decrease in the amount of fused needle disease present during the second season and also a considerable and significant height increment as compared with similar plots when unfertilized. The effect of superphosphate treatment was confirmed in a striking manner in subsequent field experiments illustrated by blocks NA, NB, NC, and ND. Ammonium sulphate in all cases causes a depression in growth and increases the severity of fused needle disease.

The reaction initiated by the superphosphate was apparently due to the increased amount of raw organic matter, formed by the resulting vigorous growth of plants forming the ground cover, together with the stimulated activity of the mycorhizal fungi. The effect of direct applications of organic litter was also beneficial, but was not prolonged as in the case of superphosphate, possibly on account of the effects of ageing on the litter and the fact that supplies of fresh matter were not added. In this regard it is noteworthy that, in the pot experiments used in connection with humus applications, the addition of N.P.K. fertilizer had no effect on plants after the effect of the humus application had worn off. In this case there was also no effect experienced by plants growing in humus free soil when given this fertilizer treatment. This would also support the contention that the superphosphate has little direct nutrient effect when applied to the conifers in question. The effect of adding superphosphate to the litter dressing was to increase the benefits which are caused by either alone.

An improvement in all plots save the unfertilized clean chipped ones was noticeable as the trees aged, and was conceivably due to the gradual development of an adequate litter horizon. In the case of the superphosphate treated clean chipped plots, the response shown may be expected to cease with time and the diseased condition to return to that of the simple clean chipped plots (see footnote).* This theory is postulated for the reason that the superphosphate may make organic matter already present in the soil of the clean stripped plots available; but with the absence of litter to replace that used, these plots should eventually return to the fused needle condition. This is borne out by the absence of response obtained from the pot experiments already described when soil lacking organic matter was treated with the same N.P.K. fertilizer mixture, and by the tendency towards fusion of the superphosphate treated trees in Block K.

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* It is of interest to note that the postulation concerning the eventual onset of fused needle conditions in the superphosphate treated clean chipped plots has been confirmed by results just obtained from the midsummer observations carried out in January, 1940. In the case of all the blocks (K, L, and M) containing this treatment there has been a definite increase in fused needle disease, whilst in the case of treatments involving the application of superphosphate to plots on which the natural ground cover was allowed to accumulate, with in some cases litter additions, the percentage of diseased trees has continued to decrease. The results are summarized in the following table :—

The Percentage of Fused Needle Disease in 1939 and 1940 in the Various Fertilizer Blocks Referred to in the Text.

Block.	Clean Chipped.		Superphosphate + Clean Chipped.		Litter.		Control. (Natural Cover.)	
	1939.	1940.	1939.	1940.	1939.	1940.	1939.	1940.
K	89·0	88·0	26·3	30·8	51·5	52·1	70·4	64·6
L	18·0	41·8	3·8	10·5	9·8	27·4	9·7	20·9
M	12·8	18·9	1·3	13·7	6·0	12·6	3·7	5·2

Block.	Superphosphate + Litter.		Superphosphate + Natural Cover.		Litter.		Control. (Natural Cover.)	
	1939.	1940.	1939.	1940.	1939.	1940.	1939.	1940.
NC	3·2	0·8	7·0	0·7	18·1	18·1	39·5	39·5
ND	1·0	1·0	4·3	3·4	52·0	59·1	41·6	44·8

TABLE XXVII.

SUMMARY OF RESULTS OF SOIL TREATMENTS.

Block.	Period.	Results of Treatments.													
		Superphosphate.		Litter.		N.P.K.		Litter and Superphosphate.		Clean Chipped.		Control.		Ammonium Sulphate.	
		G.	H.	G.	H.	G.	H.	G.	H.	G.	H.	G.	H.	G.	H.
K	1935-39	++++	++++	+++	++					— — — —	— — — —	++	+		
L	1935-39	++++	++++	++++	+++					— —	— —	+	+		
M (*P. taeda*)	1935-39	++++	++	++++	++					—	—	+	++		
NA	1935-39					++++	++++					+	+		
NB	1936-39					++++	++++					+	+		
NC	1937-39	++++	++++	++	++	+++	+++	++++	++++			—	—	— — — —	— — — —
ND	1937-39	++++	+++	— —	— —	+++	++	+++	+++			— —	— —	— — —	— — —

G = growth.

H = freedom from fused needle disease.

For the purpose of summarizing, the results of the various major treatments used in the experiments have been grouped in table XXVII. The various treatments have been given units according to the relative effects produced at the time of the final examination. The range extends four units in the positive directon (+ + + +) towards health and vigour and a similar number of units (— — — —) in the negative direction towards the diseased state and the lowest growth rate. Two columns are given to each treatment. The first records the results as affecting growth and the second deals with the amount of disease present.

The pine trees in all superphosphate treated plots in any of the experiments gained a healthy dark-green colour with a dense foliage, and it was noted that the mycorhizal fungi, *Rhizopogon roseolus* and *Boletus granulatus* (Young 1936, 1937) began fruiting freely on these plots although no fructifications were visible elsewhere save in healthy pine stands. The presence of *Rhizopogon roseolus* was particularly noticeable on account of the burrows dug by the bandicoots (*Isoodon obesulus* Shaw.), in search of the subterranean sporophores, of which they appear particularly fond. It was also noted that, in the case of all the superphosphate treated plots, the trees retained their needles for two or more years instead of one as is the case in a badly affected area.

Soil analyses demonstrated that the amount of available phosphate (citric acid extract) present cannot be correlated with the incidence of fused needle disease, but that the quantity of total phosphate (20 per cent. hydrochloric acid extract) present in the surface horizons was directly connected with it.

A total phosphate content of over 135 p.p.m. in the top 4 inches of the soil was found to be essential for the satisfactory development of *Pinus taeda* on the Beerwah soils. Somewhat less is sufficient for *P. caribaea*.

Chemical analyses of pine needles and leaves of other vegetation growing on these soils show that their phosphate contents are related to the amount present in the soil when there is a deficiency in this substance, but that when there is enough present for healthy growth the foliage content tends to be constant.

THE PRACTICAL APPLICATION OF TREATMENTS IN PLANTATION MANAGEMENT.

The first responses to treatment of the fused needle condition were given by trees to which an addition of litter had been supplied. The carrying out of such a treatment in routine plantation work would be impossible on account of the prohibitive costs involved when considered in relation to the value of the product. The formation of a litter was, however, found to be greatly encouraged by an alteration in the system of tending. The old system consisted in cutting all extraneous vegetation by means of a brush-hook down to a height of about two feet above the ground. It was found that if the brushing were carried out as near to the ground surface as possible all the cut vegetation then lay on the surface instead of being suspended by sticks and stumps as was the case with high brushing. In this way a mulch was formed on the soil surface by a lowering of the cutting height, whereas with a high cutting level the material which could have formed the mulch was largely kept out of reach of the plant roots. The cost of the low brushing was in excess of that for the high brushing but not enough to warrant its non-adoption. This technique has now been uniformly applied to fused needle susceptible areas and a marked improvement of the mulch on the soil surface has resulted.

The superphosphate fertilizer dressing has also been followed up in general practice and it has now been found practicable and advantageous to provide all areas at Beerwah and Glasshouse Mountains which show signs of typical malnutrition with a broadcast dressing of superphosphate at the rate of 3 cwt. per acre. This rate of application is, for the soils in question, adequate for the production of vigorous pine growth, but until experimental results, dealing with the actual rate of dressing which is most economical as well as satisfactory, have been concluded it is considered advisable to administer a safely excessive broadcasting. The cost of dressing an acre of the type of country in which the disease usually occurs is from 15s. to 17s., depending on the accessibility of the site, and as this will save a number of years of those which otherwise would pass before the stand reached maturity, if ever, under untreated conditions, it will be seen that the treatment is not expensive. The fact that many untreated trees would, if they eventually recovered by natural processes, be of such poor form as to be unmarketable is also worth considering. The areas so far treated with the fertilizer have made a very satisfactory recovery, and besides producing a normal growth rate and gaining a healthy, well-clothed crown, have now commenced to set normal seed for the first time. In the diseased state fertile seed is seldom produced.

As was the case in experimental treatments, fertilizer broadcasts did not visibly affect the treated trees greatly until the second season after the dressing, when a count made in a treated area of known history returned a 100 per cent. recovery of affected trees. This area had previously been affected to the extent of 70 per cent. of the stems.

It is possible that the introduction of the superphosphate treatment to forest plantations may be of great value in converting land hitherto considered to be of too poor a type for planting, from a nutrient standpoint, into such a condition as would provide satisfactory coniferous plantation areas. When applied to areas considered as failures it is thought that in many cases results similar to those obtained at Beerwah will occur, and areas which were disappointing may in all probability become equal to the best. It is not claimed, however, that fertilizing with superphosphate will cause satisfactory plantations to develop on poorly drained sites or sites which are characterised by soils with a mechanical structure unsuited to pine growth. The fertilizer also cannot be expected to make a tree planted out of its climatic environment grow as well as it would in a more suitable location.

It is hoped that, by means of a simple chemical analysis to determine the total phosphate content of the soil, each plantation site may be graded as to phospate requirement. It is considered from the evidence available that a phosphate value of over 150 p.p.m. in the top 4 inches of soil is desirable for vigorous growth of *Pinus tæda* and of over 110 p.p.m. for *P. caribæa.* The amount of fertilizer necessary to bring any particular soil to this value is a matter for calculation and experiment.

With sandy soils with low phosphate fixing capacity on account of their paucity in iron and alumina it is considered that soluble phosphate such as superphosphate should not be used as it would be quickly leached out. Ground rock phosphate in this case would be more suitable, as it is applied in an already insoluble condition. The amount of each fertilizer to be added should of course be estimated from their relative phosphate contents. The treatment of soils of low phosphate value but with abnormally high acidities such as obtains in a case at Beerwah on an organic sandy swamp with a pH value of 3·6 is being investigated, and will probably consist of a combination dressing of lime and either rock or superphosphate.

The use of phosphate fertilizers on such soils as those described above opens up great possibilities for the successful exploitation of the large areas of this type of country, available in Queensland and elsewhere, for the production of exotic conifers.

[TO BE CONTINUED.]

PREVENT BUSH FIRES.

Carelessness Costs Lives and Money.

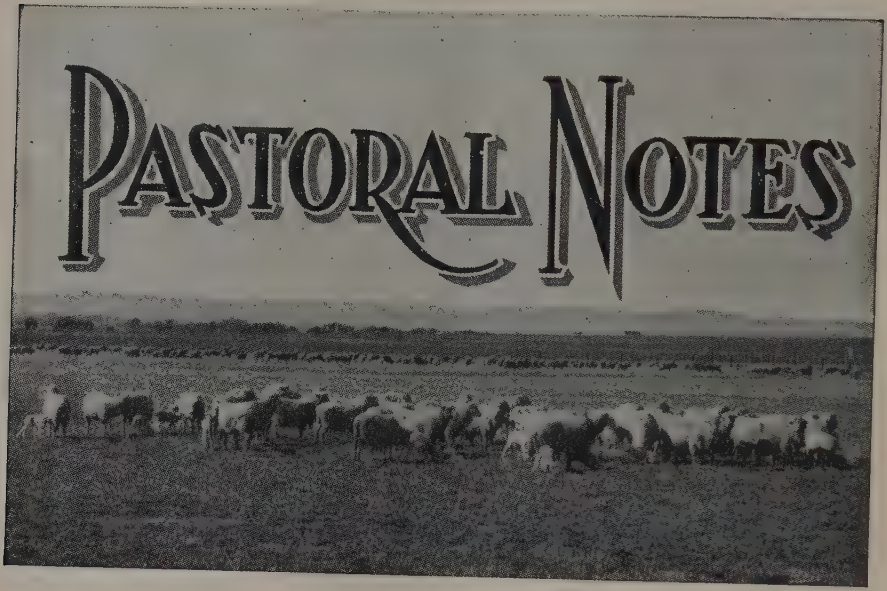
The following points are worthy of careful consideration by the various committees controlling bush fire brigade operations, in order that such suggestions, where found practicable, may be circulated among those concerned:—

1. Publicity.
2. Educational activities.
3. Enforcement of regulations and ordinances in respect of fire breaks and removal of any bush and scrub which may be a menace to adjoining property.

The following rules are suggested for the prevention of fire in bush and scrub country:—

1. Matches.—Be sure that your match is out. Break it in two before you throw it away.
2. Tobacco.—Be sure that pipe ashes and cigar or cigarette ends are dead before throwing them away. Never throw them into scrub, leaves, or litter.
3. Making Camp.—Before building a fire, scrape away all inflammable material from a spot 5 feet in diameter. Dig a small hole in the centre of the cleared area and in it build your fire. Keep your fire small. Never build it against trees or logs or near scrub.
4. Breaking Camp.—Never break camp before your fire is out.
5. How to put out a camp fire.—Stir the embers while soaking them with water. Turn small sticks and drench both sides. Wet the ground around the fire. If you cannot get water stir in earth and tread it down until packed tight over and around the fire. Be sure the last spark is extinguished.
6. Burning Scrub.—Never burn bush or scrub in windy weather nor while there is the slightest danger of the fire getting away. Burning, however, must be restricted to those periods during which it is legal to burn.

Most bush fires are man made.



"Pink-Eye" in Sheep.

"PINK-EYE," or infectious ophthalmia, has been known for many years in Australia, and though the mortality is very slight, deaths may and do occur in drought or semi-drought areas where, because of blindness, sheep are unable to get to water.

A great deal of trouble follows outbreaks in travelling mobs of sheep or during mustering for shearing and other purposes, for the disease is then very difficult to check.

Material from the infected eye of a sheep transferred to the healthy eye of another sheep reproduces the disease, and healthy sheep grazing on tall pasture (for instance, most seeding grasses, &c.) and running with infected sheep may also suffer. If, however, the grass is kept well cropped down, the liability to infection is considerably reduced. It is presumed, therefore, that in the field, "pink-eye" is not transmitted from sheep to sheep by direct contact, but by the material from the infected eyes being brushed off by grass or herbage, and thus conveyed to the eyes of healthy sheep. Flies also may spread the disease.

An attack of the disease appears to convey an immunity, but if only one eye of the sheep is affected, this is the only eye which possesses the immunity.

It is also known that exudate from the eye becomes non-infective after drying for a short period. Thus, in fine weather, healthy sheep can be turned into previously infected paddocks or driven over stock routes without risk twenty-four to forty-eight hours after infected sheep have been moved out of these places. There is also some evidence to show that any injury to the eyes through dust, grass seeds, or anything else increases the liability to infection.

The symptoms can be divided into three stages which ordinarily follow one another, although it is quite common for the trouble to clear up at the second stage and not proceed to the final stage of ulceration.

The first stage is characterised by a discharge from one or both eyes, and on examination the membrane surrounding the eye is found to be inflamed and the eyelids swollen. These symptoms are followed by the second stage, in which the front of the eyeball becomes smoky or opaque. A scum is gradually formed through which small branching blood vessels may be seen and a varying amount of pus is present in the corner of the eye.

By this time the sheep is quite blind in the affected eye, and shows signs of acute pain, while the least sound will disturb the animal, causing it to rush blindly in any direction with its head held high, progress being stopped only by violent contact with a fence or some such object.

The third stage, which is not seen in all affected sheep, is one of ulcer formation in the front of the eye. Sometimes the ulcers appear to burst, and the eye becomes practically covered in pus.

Many cases, however, do not go as far as this, and even if left untreated the animal may recover with little or no loss of sight, although complete recovery probably takes a month or even longer.

As in many other diseases of sheep, treatment depends on the facilities for handling the sick animals. All affected sheep should be at once isolated and cut up into small hospital mobs held in small shady paddocks, handy to water, where they can be supervised easily.

A few drops of a 2½ per cent. solution of zinc sulphate in water, made by dissolving 1 oz. zinc sulphate in 1 quart of water, should be dropped into the affected eyes by means of a shearer's oilcan. All pus and other matter is wiped from the eyes with cotton wool soaked in this same solution.

This treatment should be carried out as frequently as possible, and usually the disease will clear up after about a week.

RIGHT TYPE OF EWES FOR LAMB-RAISING.

No matter what ram is fancied, if merino ewes form the mother flock, the fat lamb-raiser is handicapped in the matter of profitable weights at an early age, or, in other words, early maturity.

The ewe most suitable for the production of early maturing sucker lambs for export is got by the use of rams of one of the long-woolled breeds—such as the Romney Marsh, Border Leicester, or Lincoln—on the strongest, boldest type of merino ewe procurable. The ewe lambs from the resultant drop should be retained as the future breeding flock.

Purebred Corriedale ewes also are recommended as dams in a fat lamb-raising flock.

On either type of ewe a Downs ram—such as the Southdown or Dorset Horn—should be used.

The ewe flock should be maintained in good, strong, store condition until lambing time. After lambing, no feed is too good for the ewe and lamb.

Under favourable conditions, fat lambs should be marketed at four months of age.

REDWATER IN CATTLE.

There are two kinds of redwater in Queensland. Both are caused by minute blood parasites and are carried by the tick. The differences between these two organisms are so small that they can only be recognised under the microscope. It is impossible to determine which type of redwater is present by an examination of an an[illegible] the field. Fortunately, this is not necessary.

During the last few years intensive efforts have been made to find a suitable drug which would be effective in treatment and yet easy to apply. For many years piroblue held favour. This is effective in the treatment of one kind of redwater, but is ineffective against the other. Unfortunately, the common form in Queensland is unaffected by piroblue. Moreover, piroblue has a great disadvantage in that it requires to be used intravenously—i.e., it must be inoculated into the jugular vein.

Acaprin is now used largely in the treatment of redwater outbreaks, and is known to be effective against both forms of the disease. It is easily applied because the dose is small and it can be injected subcutaneously—under the skin. Supplies of the drug are kept on hand at the Department of Agriculture and Stock and by leading chemists. It is put up in the form of a solution and in single doses.

In areas where redwater is common, owners should keep a few doses of the drug on hand, together with a small hypodermic syringe.

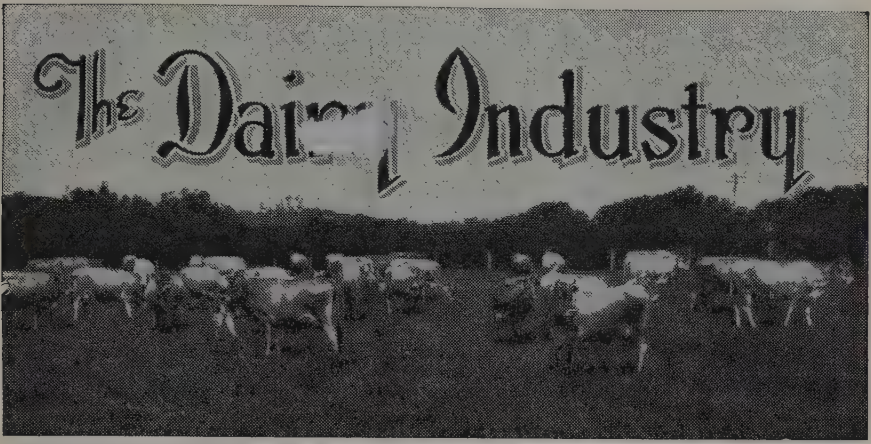
Cases should, of course, be treated as early as possible, but even those which look hopeless at the start will, within an hour or two, show improvement, and so go on to recovery. A second injection can also be given without harming the animal in any way.

PASTURE MANAGEMENT.

If seasonal rains occur, many of the pastoral areas in Queensland may soon be well covered with grass and herbage. If widely distributed summer rains do fall, a good autumn crop of long grass should be assured. The effect of autumn long grass is to supplement the organic constituents of the soil. This augmented organic content will tend to maintain the fertility of the pastures. In ordinary circumstances, pastures should not be burnt off. This applies especially to sown pastures, such as paspalum and Rhodes grasses. The effect of a severe grass fire is to reduce greatly the potential supply of the organic constituents of the soil. If persisted in, the practice of burning off may result in sterility of the soil. It is possible that bush fires recurring annually form one of the principal factors in the reduction of the fertility of much open forest country to far below that of rain-forest country.

In burnt-over areas, an invasion of non-nutritious grasses may always be looked for. In particular, the farmer with paspalum pastures can watch for the entrance of carpet grasses and rat's-tail grass. The prompt eradication of these almost worthless intruders may mean the saving of many weeks of labour in two or three years' time, when, otherwise, these invading grasses shall have spread and seeded.

In paspalum pastures, ordinary white clover should be fostered. A good pasture of this kind can often be established by broadcasting a few ounces of white clover seed to the acre in a paspalum paddock. This can be done during autumn. Generally, white clover prefers a sandy soil.



What is a Fair Over-run?

THE over-run paid out by butter factories is a much-discussed subject among dairy farmers. A question frequently asked is: "What is the maximum over-run obtainable by a factory where all weighings, tests, and other operations are carried out correctly." Here is the answer:—

Over-run in Queensland is the excess butter actually manufactured over the amount of commercial butter (estimated from the approved chart) obtainable from all cream received at the factory. Butter of legal composition must contain at least 82 per cent. of fat, and to obtain the maximum over-run a factory must, therefore, convert every ounce of fat which it receives in the cream into butter containing exactly 82·0 per cent. of fat. Under commercial conditions this is impossible, as there is a proportion of the fat lost in various ways. There is a certain amount of cream spilt, or lost in other ways, during sampling, tipping, and processing; a further quantity of fat is lost in the buttermilk and, finally, there is a loss of butter in the packing process. The percentage of the total fat lost in these ways is approximately 0·2 per cent. in spillage, &c., 1 per cent. in the buttermilk, and 0·25 per cent. in packing—making a total fat loss of approximately 1·45 per cent. The effect of this loss is best illustrated by an example.

One thousand lb. of cream with a fat test of 40 would be paid for as 489 lb. of commercial butter. The actual quantity of fat in this weight of cream is 417 lb. A loss of 1·45 per cent. of this fat means that 6 lb. of fat is lost during handling and manufacture, leaving 411 lb. of fat which can be manufactured into butter. The maximum weight of butter of legal composition which can be manufactured from this quantity of fat is 500 lb., and the maximum over-run is therefore 11 lb. of butter on the estimated quantity of 489 lb.—equivalent to 2·25 per cent. It is not possible for a factory working under commercial conditions to consistently obtain this over-run, and it can be taken for granted that the over-run obtainable should be no higher than 2 per cent. A factory can only consistently exceed this figure by one or more of the following practices:—

(*a*) Cutting the weights of the cream.
(*b*) Cutting the fat tests.
(*c*) Manufacturing butter of illegal composition.

In the manufacture of unsalted butter, the over-run obtainable is considerably less than the figure given above. The maximum over-run obtainable on unsalted butter is 1 per cent., but under commercial conditions it is doubtful whether it could exceed 0·75 per cent. A factory which manufactures both salted and unsalted butter should, therefore, have a lower over-run than one which makes salted butter exclusively.

CALF-FEEDING.

About 87 per cent. of cows' milk is water. Of the remainder, nearly one-third is fat, and a good separator, if properly operated, will remove about 95 per cent. of this fat. Very little protein is removed. It follows that, if the separated milk is to be made equal in feeding value to the original milk, either the fat or its equivalent must be replaced. There is no need to place protein, and for this reason it is not good practice to feed such protein-rich materials as linseed meal in conjunction with skim milk to very young calves.

Dripping obtained from a reputable meatworks, or cod liver oil, may be incorporated in the milk, but they are rather expensive and difficult to mix properly. A better system is to use finely-ground maize. Maize meal from good-quality grain contains as much as 5 per cent. high-grade oil and 70 per cent. of easily digested carbohydrate, which, to some extent, serves the same purpose as fat.

The new-born calf should get whole milk for a fortnight if it is to be given a good start in life. For the first few days it may be fed three times daily; after that, twice daily is enough. A safe level to feed is 1 gallon to each 100 lb liveweight. At the end of the second week a little maize meal is stirred into the milk and the change to separated milk begun. By the end of the third week the maize meal may be built up to a handful, and the change to separated milk completed. By the end of a month the calf begins to nibble grass, and can consume about ½ lb. of meal.

From then on to the eighth week the milk can be replaced progressively by water and a meal mixture. By the eighth week the calf will be able to eat up to 2 lb. daily of a suitable meal mixture.

Such a mixture may contain 35 lb. of linseed meal and 65 lb. of a cereal meal. Pollard and bran should not constitute more than one-half of the cereal meal. The remainder may be crushed oats, barley, or maize. About ½ lb. of salt and 2 lb. of sterilised bone meal should be included in the mixture.

As the animals takes more grass or hay, the supply of the meal mixture is restricted. At six months, unless an adverse period is encountered, the calf should be able to fend for itself.

The PIG FARM

Before Winter Comes.

BEFORE winter comes, some preparations should be made to ensure comfortable quarters for the pigs on the farm. Although in Queensland the stock may not use the shelters for a long period, when they do have need of cover it should be ready for them.

First of all, the drainage from the piggery should be inspected. After the wet season the drains are often silted up, and pools may have been turned into deep, foul wallows. The drains should be cleared, and the wallows drained and filled in. This will prevent water from lying in the yards after winter rains. Wet, sloppy yards in the winter time make the pigs uncomfortable, and consequently more or less unthrifty. In addition, the discomfort to the men who have to carry on routine feeding, &c., in the piggery is of some importance.

Where the sheds and feeding troughs are movable, they should be shifted to a fresh site. If the sheds and troughs are fixed, any holes or wallows against them should be filled. Then the sheds themselves should be inspected for cracks in the lower walls and floor. Any such cracks should be closed to prevent draughts, which are liable to cause rheumatic and muscular disorders in the pigs. Guard rails should be examined in the farrowing sheds, and all troughs cleaned and examined for necessary repairs.

At the end of summer there is usually a quantity of rank grass growing. If cut and stacked, this will be useful as bedding for winter litters.

Fences in a piggery generally need some attention during the year, and while the other work is being carried out it is advisable to inspect the fences for loose wires and posts, and to fill in holes made by pigs trying to root under the fence lines.

Where foods are boiled for pigs, it is a good plan to examine the fireplace and boiler and ensure that it will not be necessary to make repairs during the winter months when the boiler will be in daily use.

Although much of this labour may appear unnecessary, the farmer who understands animal management will realise that, apart from the fact that equipment is receiving an overhaul, the work is being done with one main object—to ensure the comfort of the stock. Where pigs are kept under comfortable conditions, they generally prove more economical growers than those which are neglected, for the contented pig is a quicker grower and usually requires less feed per 1 lb. gain in live weight. Thus, for his own benefit, the pig-raiser should make sound preparations for the winter months.

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THE FARROWING SOW.

While "in pig" the sow should be given as much freedom as possible, for activity promotes health and good digestion, to the advantage of the sow and her prospective litter.

Her food should not be stinted, but she should be kept in moderate condition. Sows which are too fat at farrowing will probably have trouble in delivery, and may also suffer from many other troubles, of which milk fever is only one. On the other hand, if the sow is kept too short of food, she cannot nourish the young pigs properly while carrying them, nor can she suckle them properly when born.

At the time of farrowing a close watch should be kept by the usual attendant—strangers upset the sow—who should not interfere unless there is evidence of trouble in parturition or the sow attempts to bite her young. This sometimes happens when some of the pigs remain to be born and one of those already dropped tries to get to the teats; especially if it squeals, the sow—usually a young one—will seize the piglet in her mouth and quickly squeeze the life out of it. Should she break the skin and taste blood, she may turn on the rest of the litter and eat them. The attendant can prevent this by taking each piglet as it is dropped and putting it aside in a straw-lined box until all are born, when they may be put on to the teats and all will be well.

For the first two weeks after farrowing the sow does not require more food than she received during the last two weeks of pregnancy, but after this the supply should be gradually increased as she requires it.

There is nothing commoner than deficiency diseases in young pigs caused by the absence of the requisite amount of mineral matter in the food. Mineral matter is contained in fish meal, while cod liver oil, with its essential vitamins, stands pre-eminent as a constituent in the food of young pigs. One teaspoonful of cod liver oil twice a day is sufficient for pigs up to ten weeks old.

Draughts, dampness, and uncleanliness, as well as unsuitable food for the mother, will cause scouring, which may lead to death.

Given reasonable care and attention, no trouble should arise, and this little extra care means the difference between a strong, healthy litter and a few stunted, unthrifty runts.

Registered Hatcheries

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire	White Leghorns, Australorps, and White Wyandottes
F. J. Akers, Eight Mile Plains	Elmsdale	Australorps
E. J. Blake, Rosewood	Sunnyville	White Leghorns, Australorps, White Wyandottes, and Rhode Island Reds
R. H. and W. J. Bowles, Glenmore road, North Rockhampton	Glen	White Leghorns and Australorps
J. Cameron, Oxley Central	Cameron's	White Leghorns and Australorps
M. H. Campbell, Albany Creek, Aspley	Mahaca	White Leghorns and Australorps
J. L. Carrick and Son, Manly road, Tingalpa	Craigard	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme	Australorps, White Leghorns, Rhode Island Reds, and Rhode Island Whites
T. G. Crawford, Stratford, via Cairns	Rho-Isled	Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros.	White Leghorns
Elks and Sudlow, Beerwah	Woodlands	White Leghorns and Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's	Australorps and White Leghorns
Gisler Bros., Wynnum	Gisler Bros.	White Leghorns and Australorps
G. Grice, Loch Lomond, via Warwick	Kiama	White Leghorns and Australorps
J. W. Grice, Loch Lomond, via Warwick	Quarrington	White Leghorns
Mrs. M. Grillmeier, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. and C. E. Gustafson, Box 24, Tannymorel	Bellevue	Australorps, White Leghorns, Langshans, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby	White Leghorns and Anconas

Name and Address.	Name of Hatchery.	Breeds Kept.
J. McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Brown Leghorns, and Australorps
F. McNamara, Vogel road, Brassall, Ipswich	Fammara	White Leghorns and Australorps
A. Malvine, junr., The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore	Stonehenge	Australorps and White Leghorns
W. J. Martin, Pullenvale	Pennington	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview	White Leghorns
F. S. Morrison, Kenmore	Dunglass	Australorps, White Leghorns, and Brown Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood	White Leghorns
J. W. Moule, Kureen	Kureen	Australorps and White Leghorns
D. J. Murphy, Marmor	Ferndale	White Leghorns, Brown Leghorns, Australorps, Light Sussex, and Silver Campines
S. V. Norup, Cooper's Plains	Lilybank	White Leghorns and Australorps
H. W. and C. E. E. Olsen, Marmor	Squaredeal	White Leghorns, Black Leghorns, Australorps, Anconas, Langshans
A. C. Pearce, Marlborough	Marlborough	Australorps, White Leghorns, Rhode Island Reds, Light Sussex, White Wyandottes, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Douglas street, Oxley Central	Pennefathers	White Leghorns and Australorps
G. Pitt, Box 132, Bundaberg	Pitt's	White Leghorns, Brown Leghorns, Australorps, Langshans, Light Sussex, White Wyandottes, Rhode Island Reds
G. R. Rawson, Mains road, Sunnybank	Rawson's	Australorps
J. Richards, Atherton	Mountain View	White Leghorns and Australorps
H. K. Roach, Wyandra	Lum Burra	Australorps and White Leghorns
C. L. Schlencker, Handford road, Zillmere	Wyndyridge	White Leghorns
A. Smith, Beerwah	Endcliffe	White Leghorns and Australorps
A. T. Smith, Waterworks road, Ashgrove	Smith's	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	..	White Leghorns and Australorps
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkins'	White Leghorns and Australorps
W. A. Watson, Mulgrave road, Cairns	Hillview	White Leghorns
G. A. C. Weaver, Atherton	Weaver's	Australorps, White Leghorns, Buff Leghorns, White Wyandottes, Minorcas, Anconas, Indian Game, Rhode Island Reds, Barred Rocks
H. M. Witty, Kuraby	Witty's	White Leghorns and Anconas
P. A. Wright, Laidley	Chillowdeane	White Leghorns, Brown Leghorns, and Australorps
R. H. Young, Box 18, Babinda	Reg. Young's	White Leghorns, Australorps, and Brown Leghorns

Following is a list of new registrations received up to the 20th February, 1940:—

Name and Address.	Name of Hatchery.	Breeds Kept.
A. F. Buchler, Milman	Pincrow ..	White Leghorns
J. E. Caspaney, Ayr ..	Evlington ..	White Leghorns
T. Duval, Athalie Estate, Home Hill	..	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner ..	Australorps
H. Hufschmid, Ellison road, Geebung	Meadowbank ..	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
C. Mengel, New Lindum road, Wynnum West	Mengels ..	Australorps
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns
V. White, Cleveland	Pinklands ..	White Leghorns

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EFFECT OF CLIMATIC CONDITIONS ON DIFFERENT CLASSES OF POULTRY.

Two classes of birds are generally used by commercial farmers—light breeds, such as Leghorns, Anconas, and Minorcas; and heavy or dual-purpose breeds, such as Australorps, Wyandottes, and Rhode Island Reds.

Light breeds, as a rule, are of a "highly strung" nature, and very susceptible to climatic changes, particularly during the early periods of production. Rains and cold snaps will invariably check production with this type of bird. This is particularly noticeable if the birds are not housed under the intensive system. If false moults are to be avoided, the highly strung nature of the birds also makes it inadvisable to alter their location until they have settled well into production and until spring approaches.

If, for any reason, light breeds have to be handled before the middle of, say, July, go about the work quietly and, if at all possible, work only in the afternoon, for most of the birds to lay on that day will have done so by then.

The dual-purpose breeds, on the other hand, are more docile and quiet. They are not so easily disturbed by climatic changes during the early laying stages, but are more susceptible to heat, as many dual-purpose birds lay on fat. In selecting breeders, select against this characteristic and choose the most active, alert birds. Greater liberties can be taken with dual-purpose breeds in relation to change of quarters, but do not worry them or shift them during early winter, as they are not immune from false moults.

Agricultural Notes

Dodder in Lucerne Seed.

LUCERNE is grown from seed and is usually sown with the object of providing a stand for several years. With this in mind, only the best seed should be bought with an assurance that it is free from dodder.

Dodder is an annual parasitical plant found in the warmer parts of the world. Its seed germinates in the soil, sends up a stem and attaches itself to the host plant which, in Queensland, is mostly lucerne. It is leafless, with twining thread-like stems, which attach themselves to the host plant by means of tubercles; from then onwards the parasite draws its nourishment from this source and severs its connection with the soil. The immediate effect is that the host plant is called on to support not only itself but also the dodder until ultimately the exhausted plant dies, in most cases smotheerd in a tangled mass of light-brown threads. Dodder produces seed quickly, so that it can run the full life cycle (seed to seed) before the host plant dies from starvation. Dodder seeds are borne in a globular capsule with four seeds in each. These seeds are pressed together, giving them their characteristic flattened surfaces.

Unfortunately, this parasitical growth is common in lucerne fields. Experience shows that the dodder seeds cannot be removed satisfactorily from lucerne seed with cleaning machinery, or by sieving; this statement is based on many unsuccessful attempts to make saleable dodder-infested lucerne seed.

Growers of lucerne seed, in fairness to themselves as well as to those who may buy their seed, should never harvest seed from a dodder-infested field.

It should be borne in mind that any seed for sowing, or any material found to be dodder-infested, is subject to immediate seizure, and the person offering infested seed for sale is liable to prosecution. A £50 fine is provided for the sale of lucerne seed containing dodder. No excuse can be accepted for the presence in seed or feed of such a destructive parasite which can well be considered as lucerne's worse enemy.

Buyers should always insist on an assurance that the seed they are purchasing is dodder-free.

Samples of lucerne seed representing seeds purchased by farmers for their own sowing are examined free of charge, at the Seed Testing Station, Department of Agriculture and Stock, Brisbane. Samples should be of not less weight than 4 oz., and marked as follows:—

Sample of seed drawn from
bags representing a total of bags marked
Purchased from of on
Name and address of sender, and date.

It is better to send a sample for examination as soon as it is purchased, rather than wait until the crop has grown, and then find it contains injurious weeds.

WINTER AND SPRING FEED.

For winter and spring feed in coastal areas which usually have a fair winter rainfall, the winter cereals, wheat, oats, barley, and rye, are strongly recommended. If these crops are combined with a legume, such as field peas or vetches, the nutritive value of the fodder is greatly enhanced.

Sowings of these crops may be continued during May. If seasonal rains are delayed, sowings may be extended until early in July, but with such late sowings the crops will only be available for a short period.

In the absence of seed drills, broadcasting is usually adopted, sowing the legume first, and discing or ploughing it under, following with the cereals, which are broadcast and harrowed in.

Suitable varieties are:—Wheat—Florence, Warren, or Warchief; oats—Sunrise, Belah, or Algerian; barley—Skinless. Florence wheat, 30 lb., combined with Dun field peas at the rate of 20 lb. per acre, has proved a suitable mixture, as both are early maturing. Algerian oats, 30 lb., combined with vetches at the rate of 20 lb. per acre, make also a suitable combination, particularly for early sowing, as this mixture is considerably slower in maturing than the former. The early maturing varieties of oats, such as Belah and Sunrise, may also be sown with field peas if desired.

If individual crops are sown, the following rates of seeding per acre are recommended:—Wheat 60 lb., barley 50 lb., oats 50 lb., rye 50 lb., field peas, 40 lb., vetches 30 lb.

The crop should be cut and fed direct to stock as, where grazing is practised, wastage occurs through tramping.

Rape may also be grown now and during the winter months to provide an abundance of succulent feed for both sheep and pigs. Rape is not so suitable for dairy cattle, because of the taint which it may impart to milk, and to its tendency to induce bloat.

Rape may be sown early in May, drilling in 4 to 5 lb. of seed per acre. Broadleaf Dwarf Essex is the best variety.

The root crops, mangels, sugar beet, Swede turnips, and kohl-rabi may also be sown on land which has been well prepared.

A "Planet Junior" cultivator and seeder is a useful implement for this work, the seed being sown in rows $2\frac{1}{2}$ feet apart, and the plants being thinned out to 1 foot intervals. Sow mangels and sugar beet at the rate of 5 to 7 lb. per acre, Swede turnips 2 to 3 lb., and kohl-rabi 2 lb.

ONION-GROWING.

As onion sowings are usually made in April and May, the incidence of the rainfall received during the winter months is of the utmost importance, and, when deficient, has to be supplemented by irrigation. Because of its deep-rooting habit, the onion can withstand limited dry spells, but the best results are obtained where the growing period is fairly moist, with drier conditions towards maturity and during harvest.

Rich, well-drained, sandy loams, friable and easy to work, have proved the most suitable, producing onions of good appearance and better keeping qualities than those grown on heavier soil types. Sandy soils tend to produce bulbs of good size but low-keeping quality, while heavy soils will induce thickened or bull-necked plants.

The preparation of land intended for onion cultivation will now be nearing completion, and it must be remembered that deep cultivation should be avoided as the sowing period approaches.

The seed may be broadcast in seed-beds from which the plants are transplanted to their permanent positions in the field. Alternatively the seed may be sown in the permanent drills. The latter method is usually adopted in Queensland, utilising the "Planet Junior" type of hand seeder, and placing the seed in drills 12 inches to 15 inches apart, which will be found to call for 2 lb. to 3 lb. per acre. The seed should only be lightly covered with not more than ½ inch of soil, as deeper sowings germinate very poorly.

When the young plants are 4 inches to 5 inches high they are thinned out to a distance of 4 inches to 6 inches in between plants, a practice usually carried out with the aid of a 2-inch chipping hoe.

In the southern districts sowings may be commenced soon and continued until May, while in the central and northern districts the period can be extended to July. If sown too early, losses may result from flowering, while if too late the bulbs may be small owing to insufficient time in which to mature before the hot weather causes scalding. Sow late-maturing varieties early and early-maturing varieties late. Only freshly-grown tested seed should be utilised, as onion seed deteriorates rapidly, and it is therefore preferable to buy seed from reliable sources.

The Brown Spanish type, including "Early Hunter River Brown Spanish," is the most popular, the onions being of good appearance and flavour and possessing good keeping qualities.

The hand cultivators of the "Planet Junior" type are useful for inter-row cultivation, as all weed growth must be kept in check. The soil should not be thrown up against the bulbs, the object being to draw the soil away rather than towards the plants, thus inducing the formation of bulbs. If the soil is not drawn away, bending over the tops with a twisting motion will assist in the formation of bulbs. When the seed-bed has been thoroughly prepared it will be found that very little hand weeding is necessary. Further information may be obtained on application to the Department of Agriculture and Stock, Brisbane.

WHEN TO POISON GREEN TIMBER.

The autumn is the best time to poison green timber wtih arsenic pentoxide or sodium arsenite. If the job is done when the sap flow in the tree is ceasing, suckering will be reduced to a minimum.

Horticultural Notes

The Spraying of Early Beans.

BECAUSE of the high prices recently obtained for vegetables, bean growers on the North Coast are planting exceptionally early this season, and, with the use of the nicotine sulphate-white oil spray, they hope to control the bean fly sufficiently to ensure the production of satisfactory crops. Prior to the use of this spray, plantings right up to May in other years often succumbed or the yields were markedly affected because of bean fly attack.

In using the spray at present, growers must not overlook the fact, that the life cycle of the bean fly is shortened somewhat in this warmer weather. Consequently, instead of the two sprayings earlier suggested —that is, the first to be applied when the plants are four days old and the second four days later—it would be advisable to make the first spraying three days after the first beans have appeared and the second four days later, followed by at least two extra sprayings at four-day intervals. This procedure should be adopted for crops planted while the warm weather continues, that is, until the cooler weather retards bean fly activity.

Up to five and six sprayings have been applied in some cases, but recommendations involving this number of sprayings cannot at present be made, pending the completion of experimental work. Growers, therefore, will have to be guided by the number of flies apparent on the plants and the growing conditions. If warmth and moisture are plentiful the plants may survive a certain amount of bean fly attack and still produce good crops. If conditions are dry, however, the plants usually show the effects of the fly very quickly. The spraying programme will, therefore, probably need to be adjusted to the general conditions.

The formula of the spray is as follows:—One fluid ounce of nicotine sulphate, 8 fluid ounces of white oil, 5 gallons of water. For growers with large areas a larger quantity of spray may be prepared from the following ingredients:—Half pint nicotine sulphate, 4 pints white oil, 50 gallons water.

BANANAS IN AUTUMN.

During autumn trashing is an important job in the plantation, for it both minimises black end and anthracnose trouble, and allows the free access of air and sunshine, the latter being of the greatest value during cold weather.

Trashing stimulates the rate of sucker growth, and some growers, even though their areas are on unprotected windy slopes, claim that autumn trashing is preferable to treatment at the end of the winter.

In young plantations where growth has been slow, and in which the plants are now carrying their first bunch, an application of fertilizer would be helpful. A suitable dressing would be 1½ lb. of superphosphate, 1 lb. of sulphate of ammonia, and from ½ to 1 lb. of muriate of potash, applied per stool and well incorporated with the soil. Such a dressing should have been applied during March, but growers who neglected to treat their plantations, or whose area has suffered a setback through weather conditions, will find an application later on very beneficial. Without some such assistance, it is quite possible that fruit thrown during April will take six months to mature. Very slow maturing fruit is, of course, undesirable.

In the older plantations, heavy fertilizer applications may be unprofitable. Areas which are not remunerative should, therefore, be eradicated if the financial prospects do not warrant their further maintenance.

It is well worth while tagging a few bunches throughout the whole of the plantation, these tags carrying the date on which the bunch is thrown. When the bunch is cut the period of development can very easily be calculated. In this way the grower can find out which section of the plantation produces most rapidly. These areas will, of course, be the most profitable.

The marketing of immature fruit is undesirable. If necessary, during winter, the top hand on the bunch should show traces of colour.

Growers with exposed plantations should, as cooler weather advances, bag their bunches to protect them from the cold. The fruit from bagged bunches matures fairly rapidly, and is very much better in quality than unprotected fruit. Second-hand bags may be used for the purpose, but any cost involved is amply repaid by increased returns to the grower.

PARSLEY.

Parsley will grow almost anywhere and on any kind of soil which is not of too stiff a nature, although a partially shaded position and a rich, moist soil suit it best. Being a biennial, it must be sown each year in order to provide a continuous supply. It should be sown twice a year —in March and April for use in winter and spring, and again in August and September for use in summer. Seeds may be sown in shallow drills in the open ground, and the seedlings thinned out to about 6 inches apart. It frequently happens that parsley is sown too thickly and early thinning is neglected, with the result that the plants run to seed prematurely. Instead of sowing a continuous row, drop a few seeds along the drill at 6-inch intervals, and when the seedlings have developed several leaves remove all but the strongest plant in each group.

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

THE apple season has brought the usual crop of troubles associated with sending in varieties such as Granny Smith before they have reached the right stage of ripeness. It certainly is hard to understand why growers, season after season, persist in trying to sell to consumers and maintain sales of fruit which they would not eat themselves. The excuse that they are sold as "cookers" is not sound, as the Granny Smith, because of its late season popularity, will always retain its favour with the retailers.

The same applies to Stanthorpe tomatoes. Many lines have arrived on the market with too high a percentage of immature fruit. This fruit will not ripen satisfactorily and if humidity is high a large percentage develop blight and soft rots before colouring. Many lines sold by agents have been returned by the buyers. Drastic action has had to be taken to remove fruit of this class from the market.

Intense heat at the end of January caused considerable damage to most fruits, pineapples particularly. Quantities of sunburned pineapples have been taken by factories. It is stressed again that the mixing of sunburned fruit with sound factory fruit will cause confusion and rejection of the affected fruit. Sunburned pineapples taken by the factory must be kept separate and branded with a large "S" on both ends of the case with one fruit on the top layer wrapper in paper.

Mango prices dropped in consequence of the large crop of common types around Brisbane.

Stone fruits eased off. Grapes have been selling well.

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 5s. 6d. to 8s.; sixes, 6s. 6d. to 11s.; sevens, 7s. 6d. to 13s. 6d.; eights and nines, 8s. to 14s. 6d.

Sydney.—Cavendish: Sixes, 12s. to 16s.; sevens, 13s. to 15s.; eights and nines, 19s. to 22s.

Melbourne.—Cavendish: Sixes, 11s. to 13s.; sevens, 13s. to 15s.; eights and nines, 14s. to 16s.

Adelaide.—Cavendish: 18s. to 20s.

Lady's Finger.—2d. to 9½d. per dozen.

Pineapples.

Brisbane.—Smoothleaf: 1s. 6d. to 5s. per dozen; 3s. 6d. to 6s. per case. Ripley: 6d. to 4s. 6d. per dozen; 4s. to 8s. per case

Sydney.—Smoothleaf: 5s. to 8s.

Melbourne.—Smoothleaf: 7s. to 9s.

Papaws.

Brisbane.—Yarwun, 5s. to 7s. tropical case; Local, 1s. to 3s. bushel.

Monstera Deliciosa.

3s. 6d. dozen.

Mangoes.

Brisbane.—Commons, 1s. to 5s.; fancy varieties, 5s. to 7s. bushel.

Sydney.—2s. to 3s. half-bushel.

Passion Fruit.

Brisbane.—First Grade, 5s. to 8s.; Second Grade, 4s. to 5s.

Melbourne.—10s. to 12s.

CITRUS FRUITS.

Oranges.

Brisbane.—New South Wales Packing House, 18s. to 24s. bushel.

Grapefruit.

Brisbane.—Palestine, 35s. per export citrus case.

Lemons.

Brisbane.—Locals, 6s. to 13s.; Gayndah, 15s. to 20s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, 6s. to 8s. (some lower); Granny Smith, 5s. to 8s.; Delicious, choice, 7s. to 8s., poorly coloured, 5s. to 6s.; Other varieties, 4s. to 7s. Cookers, 3s. to 5s.

Pears.

Brisbane.—W.B.C., 9s. to 11s. Others, 4s. to 8s.

Peaches.

Brisbane.—3s. to 8s.

Plums.

Brisbane.—President, 7s. to 8s. Grand Duke, 7s. to 8s. Giant Prune, 7s. to 10s. Ponds, 9s. to 10s.

OTHER FRUITS.

Grapes.

Brisbane.—Roma, 4s. to 6s. Waltham Cross, 8s. to 9s. Muscatels, 5s. to 7s.

Tomatoes.

Brisbane.—Ripe, 1s. to 2s. 6d.; Green, 1s. 6d. to 2s. 6d.; Coloured, 2s. to 3s. 6d.

Too much green unsaleable fruit is being marketed by the Stanthorpe district.

Figs.

8d. to 9d. box; 2s. 6d. to 3s. tray.

MISCELLANEOUS, VEGETABLES, &c.

Watermelons.—2s. to 10s. per dozen.

Rockmelons.—4s. to 8s. per case.

Cucumbers.—1s. to 3s. bushel.

Pumpkins.—Brisbane: 5s. to 7s. bag. Melbourne: £10 to £12 per ton.

Marrows.—Brisbane: 1s. to 3s. dozen.

Lettuce.—2s. 6d. to 5s. 6d. bundle.

Cabbages.—Local: 1s. to 5s. dozen. Stanthorpe: 7s. to 9s. bag.

Beans.—Brisbane: Prime, 7s. to 10s.; Old, 3s. to 4s. bag.

Peas.—Brisbane: First Quality, 5s. to 7s. bag; old, 3s. to 4s. New South Wales: 8s. to 16s. 56 lb. bag.

Parsnips.—6d. to 1s. bundle.

Carrots.—3d. to 9d. bundle.

Beetroot.—3d. to 1s. bundle; prime quality higher; supplies short.

Rhubarb.—6d. to 1s. 3d. bundle.

South Australian Celery.—28s. to 30s. crate.

PUBLICATIONS.

A pamphlet is available on the transport of pineapples to factory. Copies can be obtained free on application to the Under Secretary, Department of Agriculture and Stock, William street, Brisbane, or Committee of Direction, Turbot street, Brisbane.

BANANA SUCKERING.

A flush growth of young suckers may appear in most banana areas after heavy summer rains.

Before they form their own root system, these suckers rely solely on the parent plant for their subsistence, and where a number are present they retard the parent plant's growth and the development of its bunch of fruit.

Most growers have a definite time for suckering in their working plan, but others fit in at any time, if at all, with the result that four, six, eight, and up to a dozen suckers, ranging in size from "peepers" to fully-grown plants, are seen, all of which have robbed the parent plant of some of its vigour.

Even in the most fertile soils the number of suckers left to bear the grower's next bunch should seldom be more than two, and sometimes three. It is desirable, therefore—particularly if a fertilizing programme is carried out—to destroy all the suckers which are not required as soon as they peep above the ground. At this stage they are easy to disconnect with little damage to the plant, and the fertilizer applied goes only to those suckers which will eventually produce the next cutting of bananas.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of January, 1940 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		LB.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (STANDARD, 350 LB.).			
Model 4th of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	14,275·1	598·454	Reward of Fairfield
Happy Valley Bluebell 4th	R. R. Radel, Coalstoun Lakes	8,869·56	379·306	Burradale Emperor
Burradale Silky 18th (197 days)	W. F. Kajewski, Glenroy, Glencoe	9,423·35	379·217	Burradale Eclipse
Glenroy Isabel (204 days)	W. F. Kajewski, Glenroy, Glencoe	8,955·75	358·626	Burradale Earl
Rosenthal Maggie 13th	S. J. H. Mitchell, Rosenthal, Warwick	8,756·83	354·571	Rosenthal Handsome Boy
	SENIOR, 3 YEARS (STANDARD, 290 LB.).			
Gem 7th of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	11,497·6	559·181	Alfa Vale Red Prince
Kyabram Mab	C. W. Black, Kumbia	11,764·63	529·323	Ledger of Greyleigh
	JUNIOR, 3 YEARS (STANDARD, 270 LB.).			
Model 11th of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	12,982·9	600·289	Reward of Fairfield
Rhodesview Strawberry 5th	W. Gierke and Sons, Rhodesview, Helidon	9,521·61	354·982	Blacklands Prospector
Penrhos Stella 5th	A. Sandilands, Penrhos, Wildash	6,576·6	276·131	Penrhos Monarch
	SENIOR, 2 YEARS (STANDARD, 250 LB.).			
Rhodesview Daisy	W. Gierke and Sons, Rhodesview, Helidon	8,468·45	332·994	Blacklands Prospector
	JUNIOR, 2 YEARS (STANDARD, 230 LB.).			
Glenroy Empress	W. F. Kajewski, Glenroy, Glencoe	10,680·25	440·944	Park View Glider
Happy Valley Pride (257 days)	R. R. Radel, Coalstoun Lakes	6,304·32	300·164	Sunnyview Artist
Glen Idol Daphne 3rd	P. Doherty, Box 31, Gympie	7,349·25	298·951	Excellency of Blacklands
Rhodesview Nancy 24th	W. Gierke and Sons, Rhodesview, Helidon	7,899·83	292·55	Blacklands Prospector
Rhodesview Fancy 7th	W. Gierke and Sons, Rhodesview, Helidon	5,975·58	238·505	Blacklands Prospector

JERSEY.				
MATURE COW (STANDARD, 350 LB.).				
Dawn of Southport	C. Huey, Ashview, Sabine	6,508·4	361·883	Werribee Twylish Starbright King
SENIOR, 4 YEARS (STANDARD, 330 LB.).				
Woodlands Fashion	D. R. Hutton, Bellgarth, Cunningham	8,181·98	416·665	Kenmore Victor
Bellgarth Lucky Girl 2nd	D. R. Hutton, Bellgarth, Cunningham	5,572·96	334·047	Bellgarth Lucky Boy
SENIOR, 3 YEARS (STANDARD, 290 LB.).				
Glenview Flower	F. P. Fowler and Son, Glenview, Coalstoun Lakes	8,054·15	438·392	Trinity Governor's Hope
Bellgarth Claire de Lune 2nd	D. R. Hutton, Bellgarth, Cunningham	7,067·51	396·325	Trecarne Renown 2nd
Bellgarth Birthday 4th	D. R. Hutton, Bellgarth, Cunningham	7,459·02	381·258	Trecarne Renown 2nd
Oxford Remus Butterfly	E. Keys, Proston	7,845·6	375·389	Overlook Nancy's Remus
JUNIOR, 3 YEARS (STANDARD, 270 LB.).				
Bellgarth Gallatea	D. R. Hutton, Bellgarth, Cunningham	6,487·9	329·203	Bellgarth Bellboy 2nd
SENIOR, 2 YEARS (STANDARD, 250 LB.).				
Bellgarth Butter Queen 2nd	D. R. Hutton, Bellgarth, Cunningham	5,725·65	328·665	Trecarne Renown 2nd
Broadview Harmony	W. S. Kirby, Byrnestown	5,213·88	264·257	Glenview Mason
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Keystone Lavender	E. Keys, Proston	5,942·8	316·156	Gunawah Gamboge Prince
Broadview May	W. S. Kirby, Byrnestown	4,884·63	271·065	Glenview Mason
Bellgarth Mabel	D. R. Hutton, Bellgarth, Cunningham	4,722·79	269·149	Trecarne Renown 2nd
Carnation Bonny Locket	D. R. Hutton, Bellgarth, Cunningham	6,173·42	267·722	Carnation Locket's Victory
Broadview Lavender	W. S. Kirby, Broadview, Byrnestown	4,445·3	240·663	Glenview Lynda's Noble
Broadview Cherry Blossom	W. S. Kirby, Byrnestown	4,265·08	237·098	Glenview Mason
GUERNSEY.				
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Laureldale Chimes	W. A. Cooke, Laureldale, Witta	6,802·1	275·355	Laureldale President

General Notes

Staff Changes and Appointments.

Mr. L. C. Home, Department of Agriculture and Stock, has been appointed laboratory assistant in the Bureau of Sugar Experiment Stations.

Messrs. John Harrison, Stewartdale, Ripley, and F. C. Limpus, North Rockhampton, have been appointed honorary protectors under the Fauna Protection Act.

Constable J. T. Johnston, Biggenden, has been appointed also an inspector under the Brands Acts.

Mr. A. R. White, border gatekeeper for the New South Wales Department of Agriculture at Stanthorpe, has been appointed also an inspector under the Diseases in Plants Acts.

Mr. D. Walsh, Horseshoe Bay, Bowen, has been appointed an honorary protector of fauna in respect of the sanctuary embracing the pasturage reserve at Cape Edgecumbe, Bowen.

The undermentioned have been appointed honorary fauna protectors and honorary rangers in respect of native plants—

> Messrs. L. Larsen (North Tamborine); Rev. W. A. Hardie (Woolloongabba); L. G. O'Keefe (Thompson Estate); C. F. Schroder (Normanby); A. C. Taylor (Annerley); J. Cuthbertson (One Mile Estate, Ipswich); W. C. Horner and E. W. Bell (Springbrook).

Mr. M. L. Cameron, Chief Clerk of the Department of Agriculture and Stock, has been appointed deputy for the Under Secretary, Mr. R. P. M. Short, as a member of the Rural Development Board during the latter's absence from Brisbane on official business.

The appointment of Mr. J. Pedelty, Burrum, as an inspector under the Diseases in Plants Acts has been cancelled, and Mr. I. L. Andersson, loader for the Committee of Direction of Fruit Marketing at Burrum, has been appointed an inspector in his stead.

Mr. W. F. Snewin (Indooroopilly) has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock.

Mr. D. R. L. Steindl, assistant pathologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock, has been transferred from Bundaberg to Brisbane.

Mr. T. K. Kelly, inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from Ravensbourne to Ramsay.

Mr. W. C. Wilson, night officer, Wacol, has been appointed an honorary protector under the Fauna Protection Act.

Mr. W. H. Schacht, of the Forests Office, Brooweena, has been appointed an honorary fauna protector.

Constable T. A. McNaught, Kajabbi, has been appointed also an inspector under the Slaughtering Act.

Mr. Hunter Freeman, until recently chief cane inspector, Macknade Mill, Herbert River, has been appointed millowners' representative on the Central Sugar Cane Prices Board in succession to Mr. E. S. Smith, resigned.

Mr. J. E. Ladewig, Inspector of Dairies, has been transferred from Biloela to Toowoomba.

Mr. H. W. Miller, jun. (Woolloongabba) has been appointed an honorary protector of fauna and honorary ranger under the Native Plants Protection Act.

Other appointments of honorary protectors under the Fauna Protection Act are:—Messrs. E. G. C. Eardley (North Gooburrum), J. E. Pashley (Gooburrum), G. E. Unkles and P. J. Mittelheuser (Burnett Heads road), F. G. Bettiens (Tirroan), W. Manderson (Gin Gin), and W. R. Douglas (Maryborough road, Bundaberg).

Egg Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the constitution of the Egg Board to provide that registration of growers' premises shall be effected not later than 30th April in each year from and after the year 1940, instead of from the 1st August in each year.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. C. T. White, Government Botanist.

Forest Blue Grass. Early Spring Grass.

J.K., Kalbar—

1. Forest Blue Grass, *Bothriochloa intermedia.* This grass is very common in Queensland, and is generally regarded as a very good cattle grass in the mixed native pasture.
2. Early Spring Grass, *Eriochloa procera.* This grass responds fairly readily to spring and early summer rains, hence the local name, though it is perhaps no more applicable to it than to several other native sorts. It is generally regarded as a very good stock grass, palatable, and nutritious.

Caustic Vine or Milky Vine.

J.R.L., Jericho—

The specimen is the Caustic Vine or Milky Vine, *Sarcostemma australe,* a plant with a very wide distribution in Queensland. Feeding tests have definitely proved the plant poisonous to stock. On the other hand, it has been reported in South Australia as quite a good fodder. It belongs to a dangerous family of plants (the Asclepiadaceae), and there is no doubt it is unwholesome. Like many succulents, including prickly-pear, it has the power of living on its own stores of food for quite a long time.

Brazilian Wax Palm.

M. Bros., Sydney—

I have not seen the Brazilian Wax Palm or Carnauba Wax Palm (*Copernicia cerifera*) growing in Queensland. It is a native of the hotter parts of Brazil, but might thrive in north-eastern Queensland, particularly about Cairns and the Daintree River. It is doubtful if it would pay to grow the palm for the collection of the wax, as it would take some time for trees to attain marketable size, and the collection of the wax is apparently a tedious business. The wax is borne on the young leaves which are shaken, and the wax then melted for local use and for export. The tree is cultivated in some tropical countries, including India, but purely as an ornamental palm, and so far as I know, has never been considered as a commercial crop in these countries.

Trees for a Windbreak—Swamp Couch.

J.D. (Toowoomba)—

1. For the purpose of a windbreak so that the branches will touch Lambertiana pines should be planted about 30 feet apart.
2. Bottle trees will probably be best planted in August or early September, after the late frosts and before the weather gets too hot.
3. The best time to plant plane trees is July or August.
5. Lambertiana pines and Arazonica pines may be head pruned if desired. This, however, is purely a matter of individual taste.
6. Swamp couch or water couch is a very bad pest in cultivation once it gets a hold. Under ordinary garden conditions continual digging out is probably the best means of eradicating it, but if you want to spray it as you suggest you would probably find the best system would be to expose the roots and spray with some weak arsenical solution or other weedicide. If the standing plants are sprayed, it would have to be done several times before it would take effect. Spraying of plants, such as water couch and nut grass only burns off the tops and leaves the underground parts unaffected, unless, of course, they are growing on a place such as a tennic court where fairly strong solutions can be applied several times.

Rural Topics

Sales Tax on Farm Equipment.

The following information on Sales Tax exemptions has been supplied by the Federal Taxation Department:—

1. In the Sales Tax law, extensive provision is made to permit exemption from sales tax in respect of certain machinery, implements, apparatus, equipment, and materials for use in the agricultural industry.

2. The term ''agricultural'' is defined to mean ''of or pertaining to agriculture, and for the purposes of this definition 'agriculture' includes viticulture, horticulture, pasturage, apiculture, poultry farming, dairy farming, and other operations connected with the cultivation of the soil, the gathering in of crops, and the rearing of livestock.''

3. The term ''agricultural industry'' includes fresh fruit packing sheds of individual fruit growers, and also co-operative fresh fruit packing sheds of fruit growers. Packing sheds owned by persons not engaged in fruit growing, or packing sheds owned by cool storage companies are not within the ''agricultural industry.''

4. Many persons engaged in the agricultural industry are under the impression that exemption from payment of sales tax applies in respect of *all* goods purchased by them. That impression is not a correct one. Exemption applies only to those goods which are actually covered by the schedule of exemptions.

5. The schedule referred to includes certain goods which are exempt no matter for what purpose they are purchased, while other goods are exempt only subject to the condition that they are for use in the agricultural industry. The former type of exemption is termed ''unconditional,'' and the latter is known as ''conditional.''

6. In the schedule of exemptions, provision also has been made for exemption to be granted in respect of machinery, implements, and apparatus not elsewhere included (and parts therefor) used in the agricultural industry, if, in the opinion of the Commissioner of Taxation, they are goods of a kind used exclusively or primarily and principally in that industry.

7. Before conditionally exempt goods can be regarded as exempt, it is necessary for the essential condition to be fulfilled, viz., to satisfy the Commissioner of Taxation that at the time of purchase the use to which the particular article is to be put is exclusively or predominantly in the agricultural industry. In this respect it should be noted that goods or equipment such as tractors, engines, tanks, &c., cannot be regarded as being exempt goods unless the condition for exemption in each case is fulfilled, viz., that they are for use in the agricultural industry, such as for, say, drawing ploughs, working pumps to raise water for irrigation purposes, or containing water for watering livestock, respectively.

8. When an agriculturist purchases goods which may be conditionally exempt if used by him for the specific purposes mentioned in the schedule of exemptions, he is entitled to obtain such goods or equipment free of sales tax, provided he furnishes a certificate to the vendor in the following terms:—

''*Sales Tax Exemptions Act*, 1935-1939.''

To the Commissioner of Taxation and the
Commonwealth of Australia.

I hereby certify that the (engine) purchased
by me from (John Smith and Co.)
on is for use exclusively in (state
the exempt purpose, *e.g.*, pumping water for irrigation purposes) .

(Signature).''

9. Notwithstanding the production of certificates given by purchasers that goods or equipment are to be used for an exempt purpose, responsibility is placed upon vendors to ensure that the goods or equipment in question can be used for the exempt purposes stated, and that they are covered by the Department's interpretation of the terms of the particular exemption. Persons engaged in the agricultural industry can greatly assist vendors, the Department, and themselves by observing the procedure abovementioned. In any case of doubt, advice should be sought from the Deputy Federal Commissioner of Taxation, Commonwealth Government Offices, Adelaide street, Brisbane.

10. The giving of fraudulent certificates by a person in order to obtain exemptions to which he is not entitled is an offence under section 29 (*b*) of the *Crimes Act*, 1914-1928, the penalty for which is imprisonment for two years.

Judging a Dairy Heifer.

When selecting a dairy heifer, the form and general character will, to a large extent, indicate whether she will develop into a good producer. When a heifer is quite young, the trained eye of the judge can see its dairy value and can discern the dairy type as distinct from the beef type. The production records of her ancestral dams on both sides are important factors in determining her future dairy value, while constitution also is important. The form of the heifer with a future as a profitable producer is, in miniature, that of a good type, fully-developed dairy cow.

Something New in Butter Churns.

The largest churn in the United States has just been installed in a butter factory in California. It was made from two sand-cast aluminium shells which, together, weigh 1,500 lb. In tests, this unit has churned 660 gallons of cream into 2,580 lb. of butter in from thirty to forty-five minutes. Because of the cubical design, the churn is said to be capable of churning butter in half the time necessary for the conventional roll-type churn. Aluminium was used in the construction of this churn in order to obtain the advantages of the lightness of the metal and its non-contaminating properties.

Infra-red Rays and Seed Germination.

Infra-red ray tests by science workers in New York State (U.S.A.) indicated a very noticeable stimulation as well as an increase in seed germination. In these tests, seeds were subjected to infra-red rays. The lamp used is attached to any 110-volt electric circuit, and is moved slowly and carefully at a set distance above the surface of the seeds. Ten seconds has been found to be the most effective time for keeping the lamp in any one position. The success of these tests indicate possibilities for improving market garden production by ensuring better germination.

A New Milk Process.

''De-aired'' milk is the latest development in America. It is claimed that this new process improves the flavour and nutrition of the milk, and makes a more concentrated food.

Possibly with ''de-aired'' and ''de-watered'' milk we would have just ''condensed'' milk in another form. Anyhow, new ideas are always welcome.

Rough on Rats.

Because of the serious depredations on food stocks by rats, the British Government has declared another war—a war on rats and other vermin. Periodical ''rat weeks'' are to be held during which every farmer is asked to make a special effort to destroy any rats on his own land and premises, and to do everything necessary towards obtaining concerted action in these regular rat drives.

Meat Meal for Cows.

Now that Queensland dairy farmers are out to improve every branch of dairy practice, they will be interested in an experiment with meat meal, which was conducted recently at the Victorian State Research farm at Werribee, near Melbourne. The experiment was designed to find out the value of meat meal as a supplementary source of protein for milking cows on pasture. As a result of the experiment, the fat content of the milk of the cows fed on meat meal increased substantially, and the meal did not impart any taint to the milk.

Revival in Horse Breeding—War Influences.

Horse breeders in Great Britain, as well as in Australia, see a distinct gleam of hopefulness for their industry.

Apart from military purposes, both light and heavy horses are wanted for riding, transport and farm work.

For some time before the outbreak of war, trade for horses in the United Kingdom had lapsed considerably. The ploughing-up of grassland, with its accompanying subsidy of £2 an acre, has raised hopes for a better demand for good draught animals, although it is recognised that for the increased cultivation scheme, tractors will continue in extensive use. But against that is the increased demand for tractors for other purposes apart from farm work.

At a recent four-days sale of Clydesdales in Scotland, every class was cleared at a very much higher average than at the corresponding sale last year. Recent sales in England also have disclosed a distinct strengthening of trade, and, altogether, a strong revival in horsebreeding is evident.

Farm Notes

APRIL.

SUMMER fallowed wheat lands should now be in good condition, and may be maintained in good tilth by a light surface working after all rainfalls of over half an inch.

Seed wheat may be prepared and held in readiness for immediate sowing by grading and treating with an approved bunticidal dust for the prevention of smut. Copper carbonate, or the mercury dusts agrosan and ceresan, will be found effective for this purpose, using from 1 to 2 oz. to a bushel, according to the efficiency of the mixing apparatus employed.

Seed barley and oats should be treated with a mercury dust, or with formalin in preference to copper carbonate.

The main sowings of winter cereals and legumes required for winter and spring feed may be made during the month; and growers are advised to include field peas or tares at the rate of 20 lb. seed per acre, thereby increasing the nutritive value of the fodder obtained. Algerian oats predominate in present sowings, but the barleys, Cape and Skinless, in addition to the slower maturing varieties of wheat are also of value.

April and May are good months for the sowing of lucerne. The area under this valuable crop should be extended whenever and wherever possible. By sowing when weed growth is at a minimum, the young plants have a better chance to become strongly established, and there is less likelihood of the surface soil drying out and affecting germination, than if early summer sowings are made.

From 10 to 12 lb. of seed to the acre is ample on the best lucerne lands, but where sown largely for grazing purposes in the drier districts 3 to 4 lb. to the acre should be sufficient.

Root crops sown during March will be making fair growth, and should be thinned out to permit of full development. Further sowings of mangolds, swede turnips, sugar beet, field carrots, kohl rabi, and rape may be made where soil moisture is sufficient.

Information on fumigation of maize with carbon bisulphide may be obtained from the Department of Agriculture and Stock, Brisbane.

Sorghums, together with other summer fodder crops, which are approaching maturity, and are not required for green fodder, should be conserved as silage wherever possible.

Pumpkins required for storage should be allowed to ripen in the field, gathering with the short stalk attached, and storing in a dry airy shed, preferably on slatted shelves to permit of rapid inspection for possible decay.

Winter grasses and clovers may be sown during April in districts suitable for their growth, but sowings must be made on thoroughly prepared cultivation.

◆

ONE WAY OF GETTING THE PLOUGHING DONE.

Here is a good story, suggested by the intense cultivation campaign in the Old Country—

The farmer's wife to the farmer—"Bill, isn't it time to get the early ploughing done?"

And the farmer's reply—"Don't need to, Mary. When all these machinery agents get through demonstrating their new tractors they'll have everything ploughed up except the concrete cow-bails."

Orchard Notes

APRIL.

FOR overseas or interstate markets only the best fruit should be selected, and it should be graded for size, colour, and quality, and properly packed, only one grade of fruit being packed in a case.

All orchards, vineyards, and plantations not thoroughly clean should receive early attention, for from now until the next rainy season the ground must be kept in a thorough state of tilth and free from weeds in order, firstly, to retain moisture in the soil; and, secondly, to enable birds, ants, and predacious insects to get at and destroy the pupæ of fruit flies and other pests harbouring in the soil.

Banana and pineapple plantations should be put into good order, and kept free from weed growth.

Land to be planted with fruit trees should be prepared now. It is always advisable to allow newly cleared land time to sweeten before planting.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

APRIL.

Pittsworth	2nd and 3rd
Millmerran	5th
Toowoomba	15th to 18th
Dalby	22nd and 23rd
Chinchilla	26th and 27th
Kingaroy	30th April and 1st and 2nd May
Tara	30th April and 1st May

MAY.

Miles	1st
Monto	1st and 2nd
Yarraman	3rd, 4th, and 6th
Millmerran Rodeo	6th
Longreach	6th to 8th
Mundubbera	8th and 9th
Beaudesert Show	8th and 9th
Beaudesert Campdraft	10th and 11th
Nanango	9th to 11th
Blackall	13th and 14th
Roma	14th to 16th
Gayndah	15th and 16th
Mitchell	15th and 16th
Murgon	16th to 18th
Warrill View	18th
Ipswich	21st to 24th
Goomeri	23rd and 24th
Biggenden	23rd and 24th
Baralaba	23rd and 24th
Baralaba Rodeo	25th
Kalbar	25th
Gympie	30th and 31st and 1st June
Lowood	31st May and 1st June

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	23rd to 25th
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Atherton	6th and 7th
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Rocklea	14th
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

THE HOME
and
THE GARDEN

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

MEAN WHAT YOU SAY.

IT is most important that parents should mean what they say in dealing with their children, and that the children should know this. It is worse than useless to allow a child to do something one day and punish him for doing the very same thing next day. How is he to know what to expect? Last week mother did not allow him to play out on the street, but one day the week before she did. Naturally, being a clever, reasonable child, he thinks he will risk it again. Mother may not punish him.

Bribes and threats are wrong means of teaching a child to obey. If you tell a child that you will give him something nice if he does what you ask you are bribing him, and before long you will find he will do nothing unless he gets something out of it.

Very few of the parents who threaten their children mean what they say. A mother may say to her naughty child: "I will ask the policeman to come and take you to gaol." She knows it is not true. At first her threat frightens the child; then he learns that it is not true, and before long he takes no notice. Threats may turn him into a coward; every mother who wants her child to be brave should avoid them. On the other hand, if the threats are never carried out the child may grow indifferent. It is best never to threaten.

Children do not obey people whom they cannot trust, and parents who break promises to their children cannot expect to be trusted or obeyed by their children.

Speak Quietly.

Here is another point. When your child is not obedient do you become angry and raise your voice? That excites the child, and some children like such excitement very much. They will even do things they know are naughty just for the sake of seeing mother lose her temper. If parents can manage not to get angry they will find it much easier to teach their children to be obedient. Loud talking is a strain to listen to, and is bad both for children and for grown-ups. It makes the home noisy; noise makes everyone in the home nervous and irritable. Parents who always speak quietly find that their children will listen to them more willingly.

Be Reasonable.

A toddler's doings, which seem so trivial to many grown-ups, are really very important indeed to him; and the things that grown-ups think so very important mean nothing at all to him. He does not think, for example, it is important to give up his play and come to dinner as soon as he is called.

It is a good plan to allow the child a few minutes to finish what he is doing before you expect him to obey a command. Let him have five minutes' grace before mealtime and before bedtime, for instance. There are some things little children really cannot do, and yet they are often asked to do them—for instance, to sit still for a long time, to keep from making a noise for a long time. It is not fair to expect little children to do these things, which adults can, of course, do quite easily. The child's muscles are too busy growing to allow him to sit still for a long time. They need constant exercise—by wriggling and other means which sometimes annoy tired mothers—in order to grow. Only an adult, whose muscles have reached their final stage of growth, can discipline his muscles so that he can sit still for a long time. And making a noise is a part of the business of growing. The toddler's chattering and shouting are just as important to healthy growth as is the lusty crying of the healthy infant.

It is not really hard to teach a child to obey the first time you speak if you always speak quietly, never angrily; if you let the child find by experience that everything is pleasant when he takes notice quickly but not so pleasant if he does not obey. When the little child is good and obedient it is right for mother to show that she is pleased to allow some little treat.

Teach Children to Think for Themselves.

If people are to be happy when they grow up they must have learned to obey certain rules when they were children; but they must have learned to think for themselves. Children must be taught to think for themselves what is right for them to do. There are children who never do anything by themselves. They never think for themselves. They have to wait until someone tells them what to do. When they grow up they are very unhappy because they cannot be independent.

Let us teach our children to think for themselves, encourage them when they plan to do things without help, when they attempt to fasten their own shoes, to put on their own socks, to do up their buttons, to wash their faces. They may seem to be getting on very slowly. It takes time to let them make the effort to help themselves, but try to be patient while they accomplish what they are trying to do. Praise them for trying to help themselves. It will be all the better for them if they learn to be independent, and in the long run all the better for mother.

IN THE FARM KITCHEN.

BOTTLING THE GARDEN.

Here are some well-known jams made from improved recipes, and also some new recipes well worth trying.

Green Tomato Jam.

Take 7 lb. green tomatoes, 6 lb. loaf sugar, 6 lemons, 6 oz. glace ginger.

Scald the tomatoes, a few at a time, and peel. Wash and dry lemons and grate off rinds, then halve and extract the juice. Place tomatoes and lemon rind and juice in a preserving pan. Add sugar. Stir over a slow heat until sugar is dissolved, then bring to the boil. Add chopped ginger. Boil until jam jells when tested on a cold plate. Pot and seal.

Loveapple Jam.

Take 2 lb. tomatoes, 2 lemons, 2 lb. sugar, 4 oz. glace ginger.

Scald, peel, and slice tomatoes. Cover with sugar, Stand overnight. Drain syrup into a preserving pan. Bring to boil. Boil until clear and quite thick. Skim. Add chopped ginger, grated lemon rind, and strained juice of lemon. Simmer until fruit is clear.

Beetroot Marmalade.

Take 4 lb. beetroot, 3 lemons, 3 oz. glace ginger, cold water, 3 lb. granulated sugar, 4 oz. almonds, pinch of salt.

Choose young beets. Wash carefully, and remove skins. Put through a mincer. Place in a preserving pan. Cover with cold water. Bring to boil. Simmer until tender. Add sugar, salt, chopped ginger, and the grated rinds and strained juice of the lemons. Bring to simmering point and simmer until clear and thick—about an hour. When nearly ready, blanch and put almonds through mincer and add. Pot and seal up securely.

Rhubarb Jam.

Take 3 cupfuls sliced rhubarb, 3 oranges, ½ lb. blanched almonds, 3 cupfuls granulated sugar, 1 lemon.

Place the rhubarb, sugar, grated lemon rind, and strained juice of the oranges and lemon in a preserving pan. Bring to the boil. Simmer for half an hour. Chop and add almonds. Simmer for five minutes longer.

Quince Jelly.

Take 3 lb. quinces, 6 cupfuls water, 3 lb. tart apples, sugar.

Choose quinces that are not quite ripe. Rub off down with a rough cloth. Core and chop quinces and place in a preserving pan. Add water. Wipe and quarter apples and throw into pan. Bring to boil, and stew gently till soft, but do not mash the fruit. Pour into a jelly bag and allow to drip into a basin underneath. Measure liquid, and to each pint allow 1 lb. sugar. Add sugar. Stir till dissolved, then bring to the boil and boil very slowly until the jelly stage is reached. Pot and seal when cold.

Apricot Butter.

Take ½ lb. dried apricots, ¼ lb. butter, 1 lemon, 4 eggs, 1¼ lb. sugar, cold water.

Wash, halve, and quarter apricots. Place in a saucepan and barely cover with cold water. Stew very slowly till tender, then rub fruit and any remaining liquid through a fine sieve. Cool the puree. Place in the top of a double saucepan. Add sugar, butter, well-beaten eggs, and grated rind and strained juice of lemon. Stir constantly over boiling water till creamy. Pot and seal. Use in place of jam with bread or as a filling for layer cakes or tartlets.

Amber Marmalade.

Take 1 pineapple, 1 lemon, sugar, 1 grapefruit.

Pare and shred the pineapple. Wash and dry the grapefruit and lemon, then slice thinly. Measure the fruit and cover with water, allowing three pints of water to one pint of fruit. Stand covered with a cloth till next day. Boil three or more hours till the rind is tender. Set aside again till next day. Measure and add an equal amount of sugar. Boil till the jelly stage is reached. Then pot and seal.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF JANUARY IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1940 AND 1939, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Jan.	No. of years' records.	Jan., 1940.	Jan., 1939.
North Coast.	In.		In.	In.
Atherton	11·78	39	7·15	10·92
Cairns	16·72	58	13·19	26·25
Cardwell	17·07	68	10·45	19·94
Cooktown ..	14·34	64	22·24	14·27
Herberton ..	9·46	54	7·10	5·85
Ingham	15·81	48	16·29	8·80
Innisfail	20·30	59	25·42	26·32
Mossman Mill ..	18·11	27	27·07	24·98
Townsville ..	11·06	23	8·09	3·94
Central Coast.				
Ayr	11·08	53	4·23	2·88
Bowen	9·65	69	2·91	1·24
Charters Towers ..	5·35	58	4·68	2·01
Mackay P.O. ..	13·65	69	10·48	4·04
Mackay Sugar Experiment Station	13·37	43	10·17	5·07
Proserpine ..	15·04	37	15·56	6·09
St. Lawrence ..	9·06	69	2·67	5·39
South Coast.				
Biggenden ..	5·25	41	1·85	9·94
Bundaberg ..	8·57	57	2·36	8·97
Brisbane	6·34	88	7·47	1·93
Caboolture ..	7·47	53	4·78	4·20
Childers	7·26	45	1·01	6·55
Crohamhurst ..	12·04	47	6·88	4·24
Esk	5·65	53	4·79	3·01
South Coast—contd.	In.		In.	In.
Gatton College ..	4·30	41	3·69	6·56
Gayndah	4·58	69	5·84	5·13
Gympie	6·56	70	4·48	4·88
Kilkivan	5·45	61	3·00	6·72
Maryborough ..	7·06	69	2·90	8·73
Nambour	9·54	44	4·83	4·04
Nanango	4·61	58	4·45	4·35
Rockhampton ..	7·49	69	3.15	4·75
Woodford ..	7·67	53	9·61	2·75
Central Highlands.				
Clermont ..	5·05	69	0·51	4·96
Gindie	3·73	41	..	8·33
Springsure ..	4·20	71	0·91	6·82
Darling Downs.				
Dalby	3·39	70	5·28	7·97
Emu Vale ..	3·20	44	2·53	2·81
Hermitage ..	..	..	..	..
Jimbour	3·58	52	1·48	8·96
Miles	3·68	55	1·83	6·90
Stanthorpe ..	3·64	67	3·07	4·23
Toowoomba ..	5·08	68	5·72	6·78
Warwick	3·56	75	3·28	3·51
Maranoa.				
Bungeworgorai ..	2·17	26	..	6·12
Roma	3·11	66	0·80	5·19

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—JANUARY, 1940.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.				Total.	Wet Days.
		Max.	Min.	Max.	Date.	Min.	Date.		
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·76	88	76	95	21, 29	73	11, 12	2,224	13
Herberton	..	81	64	94	26	56	16, 28	710	20
Rockhampton	29·82	94	73	107	26	65	3	315	13
Brisbane	29·86	88	71	110	26	65	3	747	9
Darling Downs.									
Dalby	29·84	94	67	108	26	57	24	528	8
Stanthorpe	..	88	61	104	26	48	23, 24	307	6
Toowoomba	..	88	64	103	26	54	2, 23, 24	572	12
Mid-Interior.									
Georgetown	29·79	90	72	98	25, 26	67	14	766	13
Longreach	29·77	103	76	117	26	65	9	205	8
Mitchell	29·79	100	72	113	26	55	24	133	6
Western.									
Burketown	29·76	89	77	99	22, 23	72	8, 11	1,021	17
Boulia	29·70	101	79	113	20, 25	72	8, 9	114	4
Thargomindah ..	29·74	104	77	117	25	60	23	2	1

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	March, 1940.		April. 1940.		MOONRISE. March, 1940.	MOONRISE. April. 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	a.m.
1	5·46	6·24	6·2	5·50	11·36	12·9
2	5·46	6·23	6·3	5·49	a.m.	1·3
3	5·47	6·22	6·3	5·48	12·29	1·54
4	5·47	6·21	6·4	5·47	1·22	2·42
5	5·48	6·20	6·4	5·46	2·15	3·34
6	5·48	6·19	6·5	5·45	3·8	4·27
7	5·49	6·18	6·5	5·43	3·58	5·14
8	5·49	6·17	6·6	5·42	4·49	6·9
9	5·50	6·16	6·7	5·41	5·41	7·2
10	5·51	6·15	6·7	5·40	6·38	7·53
11	5·51	6·13	6·8	5·39	7·19	8·46
12	5·52	6·12	6·8	5·38	8·11	9·40
13	5·53	6·11	6·9	5·37	9·6	10·33
14	5·53	6·10	6·9	5·36	9·57	11·24
						p.m.
15	5·54	6·8	6·10	5·35	10·53	12·17
16	5·54	6·7	6·10	5·34	11·44	1·3
					p.m.	
17	5·55	6·6	6·11	5·33	12·39	1·50
18	5·55	6·5	6.11	5·32	1·30	2·34
19	5·56	6·4	6·12	5·31	2·21	3·17
20	5·56	6·3	6·12	5·30	3·8	4·3
21	5·57	6·2	6·13	5·29	3·56	4·49
22	5·57	6·1	6·13	5·28	4·44	5·34
23	5·58	6·0	6·14	5·27	5·31	6·23
24	5·58	5·59	6·14	5·26	6·15	7·15
25	5·59	5·58	6·15	5·25	7·1	8·9
26	5·59	5·57	6·15	5·24	7·48	9·4
27	6·0	5·56	6·16	5·24	8·37	10·0
28	6·0	5·55	6·16	5·23	9·29	10·54
29	6·0	5·54	6·17	5·22	10·22	11·49
30	6·1	5·53	6·17	5·21	11·15	..
31	6·1	5·52	..	..	..	..

Phases of the Moon, Occultations, &c.

1st	Mar.	☾	Last Quarter	12 35 p.m.
9th	„	●	New Moon	12 23 p.m.
17th	„	☽	First Quarter	1 25 p.m.
24th	„	○	Full Moon	5 33 a.m.

Apogee, 9th March, at 3.0 p.m.
Perigee, 23rd March, at 10 p.m.

On the 14th the invisible Neptune will be in opposition to the Sun, rising as the Sun sets. The first to see the planet was Dr. Galle, of Berlin, in 1846, marvellously near the position calculated by Leverrier in France. Since the far-distant body takes 164.8 days to complete one revolution around the Sun, it has only accomplished somewhat more than half of its aerial journey through six of the twelve zodiacal constellations, which vary in width. It has now crossed the border from Leo into Virgo.

On the 16th Mars will be only about 1 deg. north of Uranus. Since it takes eighty-four years for Uranus to complete one revolution, it has been nearly twice around the Zodiac since its discovery, in the constellation Gemini, by Sir W. Herschel, in March, 1782. It is now in Aries, very near the border of Taurus.

Precisely at 4 o'clock in the morning of 20th March the Sun will cross the celestial equator from south to north, and our Autumnal Equinox, with a welcome change in temperature, will arrive. Day and night are of equal length, according to Sun-dial time, on that day, and as the Sun rises due east and sets due west, it would be useful to note those points along the horizon.

Mercury rises at 7.7 a.m., 1 hr. 21 min. after the Sun, and sets at 7.9 p.m., 45 min. after it, on the 1st; on the 15th it rises at 6.52 a.m., 58 min. after the Sun, and sets at 6.50 p.m., 42 min. after it.

Venus rises at 8.51 a.m., 3 hrs. 5 min. after the Sun, and sets at 8.19 p.m., 1 hr. 55 min. after it, on the 1st; on the 15th it rises at 9.10 a.m., 3 hrs. 16 min. after the Sun, and sets at 8.10 p.m., 2 hrs. 2 min. after it.

Mars rises at 10.15 a.m., and sets at 9.11 p.m. on the 1st; on the 15th it rises at 10.2 a.m., and sets at 8.46 p.m.

Jupiter rises at 8.10 a.m., and sets at 8.0 p.m. on the 1st; on the 15th it rises at 7.28 a.m., and sets at 7.12 p.m.

Saturn rises at 9.21 a.m., and sets at 8.49 p.m. on the 1st; on the 15th it rises at 8.31 a.m., and sets at 7.57 p.m.

8th	April	○	Full Moon	6 18 a.m.
15th	„	●	New Moon	11 46 p.m.
22nd	„	☽	First Quarter	2 37 p.m.
29th	„	☾	Last Quarter	5 49 p.m.

Apogee, 5th April, at 7.0 p.m.
Perigee, 21st April, at 5.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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ANNUAL RATES OF SUBSCRIPTION.—Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND AGRICULTURAL JOURNAL

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Security in Broad Acres.

LAND values are increasing remarkably in Britain. Agricultural land particularly is going up in value because of the demand for increased food production. Some calculations show that farm land has increased in value by 10 per cent. since the war started. In some districts, farms are said to be practically unobtainable. This is the result, of course, of investors coming into the market to speculate, but deep down in the national consciousness, no doubt, is the feeling that in days of stress and social change there is no better security than broad acres. After all, the very basis of our national existence rests on the land. The land is a lasting asset, and there is no finer or more useful citizen than the farmer who intelligently works it.

The Valuation of Land.

ALTHOUGH the buying of a farm may be one of the most important events in a man's life, it is remarkable how few give full consideration to all the factors affecting the venture and the value of the land to be acquired. Generally, apart from soil fertility and suitability, it is the neighbourhood and local community services which determine the level of land values, and that is the reason why land valuators are usually influenced in their valuations by prices previously obtained for land in a locality.

Factors and circumstances which influence values are, however, very involved. The main factors to which the intending buyer, as well as the valuator, should give attention are:—The average net income which may reasonably be expected from a well-worked property from year to year. This is, admittedly, not easy, but it can be estimated by working out the probable average yields from the principal crops after allowing for seasonal and pest risks. Carrying capacity, cost of labour, prices of machinery and implements, transport, roads, accessibility, distance from railway, cream and service car routes should all be considered carefully. An estimation of the probable trend in prices of the main products of the farm also is warranted. No matter how difficult it is to form such an estimate, by attempting it a farmer will appreciate more fully the uncertainty of the factors to be considered when buying land. It also will help him to avoid the mistake of paying too much for land during a period of peak prices for the crops he plans to grow. When times are prosperous, there is always that optimistic feeling that prices will remain at the high level prevailing or rise even higher. By thinking hard over all these points, the buyer should be able to form a fair idea of the average annual returns to be expected from the property under offer. The probable net income is, as a rule, the basis of the value of a farm.

Health conditions and social amenities of a locality in which it is proposed to settle also are matters of prime importance to a prospective farm purchaser. Other contributory factors to be taken into consideration before a final valuation can be arrived at are the improvements and their condition and the cost of repairs, replacements, and of any further improvements necessary to obtain or maintain the estimated net annual income to be derived from the farm. The important fact that should not be overlooked is that there is no such thing as a fixed or an absolute value of land. Finally, a buyer should bear in mind that provision should be made for redemption of his capital outlay.

To try to reduce land valuation to an exact science, however, is "to pursue the uncatchable and to define the indefinable." To put the position accurately, land valuation cannot be made a certainty, but, on the other hand, it is no mere guess. At its best it is a careful estimate by an expert who applies to his work certain recognised principles. Regarded generally, the value of land is that given to it by the community. With country or farming land, the chief point is productivity. Productivity would be quite a sound basis if prices of products remained stationary; if drought, grasshoppers, and other plagues would take the same percentage of profit every year; and if it were certain that the profit actually earned was the highest that could be got out of the land. Actually, the value of a property is what a buyer would pay for it as it stands, including land, buildings, fences and cultivation; in short, everything except livestock, furniture, implements, and other movables.

On Buying a Property.

IN buying a farm ordinary prudence should, of course, govern the business. The first thing to do is to study the conditions in every district where the class of farming in which it is proposed to engage predominates. In every country centre there are reputable and reliable agents who possess a fund of local knowledge, and who are ready to assist anyone looking for land with sound information.

Having decided tentatively on a location, it would be wise to investigate every local circumstance on which successful farming is based—the climate, rainfall, soil, class of crops grown, productivity, suitability for other crops, and so forth. In fact, no condition likely to influence profitability should be overlooked.

Railway returns of inward and outward consignments and butter factory payments may be accepted as indexes of local prosperity. There are many other obvious ways of assessing the value of any farming property under offer and which are sure to be dictated by caution and commonsense. In matters of business, however, we should not forget that we still live in a hard, cold, covetous, unrelenting world, and when it comes to selling land, like selling a horse, not everyone of us can keep within the bounds of grace, piety and good works, wherein sin and subsequent penitence have no place. What has been said about buying a farm applies, more or less, to leasing or renting a property. In share farming, in which the personal equation is so important, other obvious factors have to be considered. In all business matters, however, when it comes to a hard and fast bargain it is well to remember the old maxim—the man who is his own lawyer has a fool for a client.

As for farming partnerships, it is wise to walk warily. Temperamental differences between farming partners have wrecked many a promising enterprise. The only real farming partnership that is known to endure is that found in the bond of matrimony—as distinct, of course, from matrimonial bondage.

The Empire and Trade.

ONE of the essential factors in winning the war is the maintenance of British overseas trade, both for its war value in providing purchasing power abroad, and also for its permanent and necessary contribution to national life and prosperity. Every man mobilised for war is immobilised for industry. Every industry mobilised for war is immobilised from the self-supporting enterprises which maintain the flow of trade and create the national wealth on which the enterprises which are not self-sustaining must draw. Great as are the resources of the Empire they are not so great that we can disregard any means, great or small, which contribute to those resources. And every organised effort should be made in Australia and every other Dominion towards the development of greater trade with Britain and among themselves. It is most important to keep the wheels of industry revolving and money circulating, unless much that makes life worth while may come to an end.

Britain, like the Commonwealth, has set a policy against profiteering, in order, chiefly, as a matter of fair dealing, but also to avoid inflation and to foster trade.

The very existence of the nation is rooted in the land industries, and it is regarded as a first principle in Empire policy that the provider of food, clothing, and shelter—that is the primary producer—should be ensured a reasonable price for essential commodities, a price providing a reasonable margin over cost of production.

When the War is Over.

FOR farmers and graziers it is not out of place to give consideration now to post-war problems of production and distribution which must inevitably arise. Already producers' organisations in Queensland are making commendable moves in this matter. As a matter of fact, it is of paramount importance to the land industries.

War production comes first, of course, but it is easy to visualise post-war problems which will, unfortunately, dwarf those which we face to-day. Obviously, we must be prepared for them.

Parasites of the Horse.

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

ALL domestic animals harbour parasites, but in no case are they seen in such large numbers as in the horse. Numerous bots and roundworms are commonly found in the stomach. The small intestine may contain some dozens of large roundworms and tapeworms, while the large intestine may simply teem with some thousands of worms, some lying free among the contents, and others strongly attached to the intestine wall.

One of the first effects of infestation by parasites is a lowering of the animal's vitality. It tires easily and is no longer able to do a normal day's work. A neglected animal loses condition and becomes weak, its coat is rough and staring, and it is subject to fits of colic and diarrhœa. Parasites are particularly damaging to young animals, causing unthriftiness and stunted growth. While the death rate from parasitic diseases is not high, a tremendous loss follows from poor development and stunting of the foals, inability to stand heavy work, increasing costs of feed and maintenance, and loss of working time through debility and colic.

The more important of these parasites occur in various organs and tissues within the horse. These are called internal parasites and include the worms and bots. Other parasites are found living on the surface of the body and are known as external parasites. Fleas, lice, ticks, and biting flies, for example, are external parasites.

INTERNAL PARASITES.

Worms.

Worms may be found in almost every organ and tissue of the horse's body, and nearly 200 different kinds of worms have been found in this host. Many of these are not known to occur in Australia, but, unfortunately, those that are here include nearly all the more serious forms.

How Infestation Occurs. (Plate 100.)

To appreciate the various measures of control recommended in this article the horseowner must understand how a horse becomes infested with worms. Worms are unable to breed and increase inside an animal, and infestation occurs only when the horse swallows worm eggs or larvæ which are present in the soil, water, or grass. The female worms in the horse lay eggs which eventually reach the exterior in the manure. From this point the life histories of the various species differ, but follow one of three main types—

(*a*) In the case of the large roundworm and pinworm, the egg continues to develop outside the horse, and eventually contains a tiny larval worm. Should such an egg be swallowed it hatches inside the horse and the larva is liberated to grow to maturity.

(*b*) The egg of other species, such as the red worms, hatches outside the horse and the tiny larva is liberated. The larva grows and eventually crawls up the grass blades and is swallowed as the animal grazes.

(*c*) Other worms such as the large stomach worms and tapeworms complete the life history only after the egg, passed as usual in the manure, is eaten by some small animal such as a fly, or possibly a mite. The small animal is known as the intermediate host. The larva reaches a certain stage of development in the intermediate host and then is ready to infect the horse.

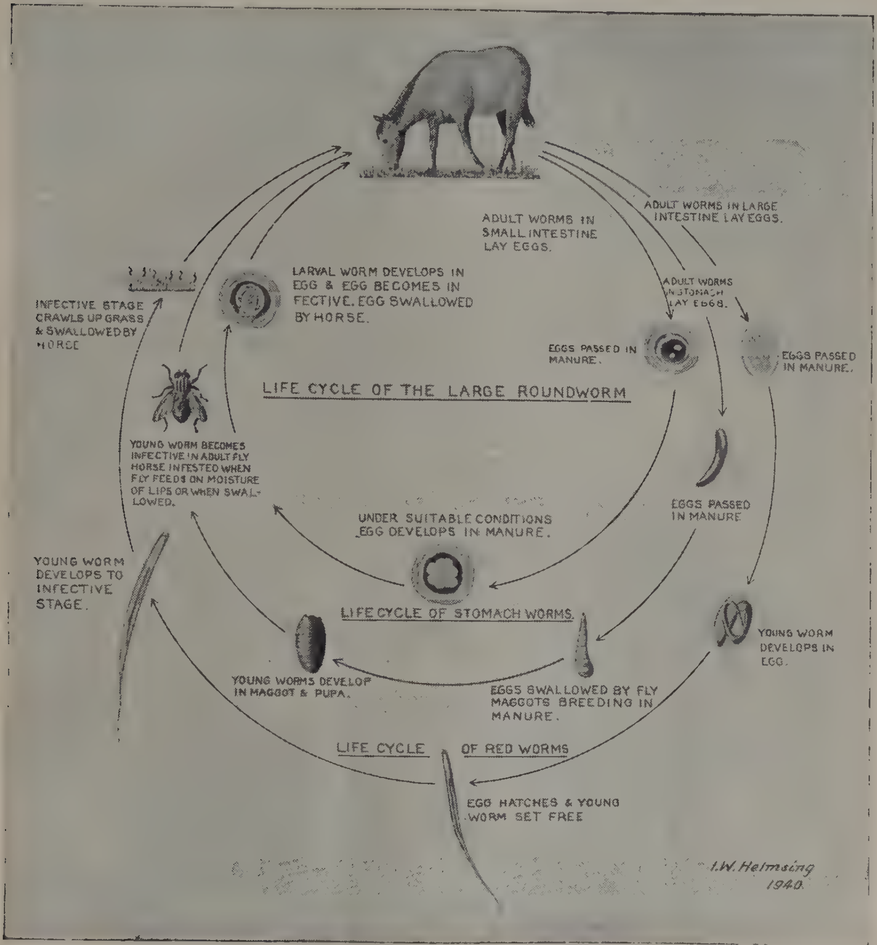

ADULT WORMS IN LARGE INTESTINE LAY EGGS.
ADULT WORMS IN SMALL INTESTINE LAY EGGS.
ADULT WORMS IN STOMACH LAY EGGS.
LARVAL WORM DEVELOPS IN EGG & EGG BECOMES INFECTIVE. EGG SWALLOWED BY HORSE.
INFECTIVE STAGE CRAWLS UP GRASS & SWALLOWED BY HORSE
EGGS PASSED IN MANURE.
EGGS PASSED IN MANURE.
LIFE CYCLE OF THE LARGE ROUNDWORM
YOUNG WORM BECOMES INFECTIVE IN ADULT FLY HORSE INFESTED WHEN FLY FEEDS ON MOISTURE OF LIPS OR WHEN SWALLOWED.
EGGS PASSED IN MANURE
UNDER SUITABLE CONDITIONS EGG DEVELOPS IN MANURE.
YOUNG WORM DEVELOPS TO INFECTIVE STAGE.
LIFE CYCLE OF STOMACH WORMS.
YOUNG WORM DEVELOPS IN EGG.
YOUNG WORMS DEVELOP IN MAGGOT & PUPA.
EGGS SWALLOWED BY FLY MAGGOTS BREEDING IN MANURE.
LIFE CYCLE OF RED WORMS
EGG HATCHES & YOUNG WORM SET FREE
I.W. Helmsing 1940

Plate 100.

How Horses Become Infested with Worms.

1. Manure not removed regularly.
2. Flies breeding in manure.
3. Food and water contaminated with manure.
4. Permanent pastures.
5. Swampy pastures.
6. Overstocking.
7. Young horses run in contaminated pastures.
8. Unsanitary stables and yards.

Control of Parasitic Worms.

The control of parasitic worms may be accomplished by a judicial combination of medicinal treatment and preventive measures.

Medicinal Treatment.—By medicinal treatment is inferred the use of certain drugs to kill and remove the worms from the horse's body.

Fortunately, this field has been given considerable attention and efficient remedies are available.

In selecting a drench for the horse several factors must be taken into consideration. The drug must be effective and it must be safe. Unfortunately, there is no single drug which is effective against every kind of worm, and in selecting a drug one must make certain which of the many kinds of worms present is the cause of the animal's condition, and is therefore to be removed. All drugs are poisons, and the condition of the horse must be given careful consideration in ascertaining the safest and most effective drug to employ and the dose to be administered. Treatment should therefore be left in the hands of the qualified veterinary surgeon as far as possible. In many districts, however, qualified veterinary surgeons are not available, and here the horseowner has no option than to treat the animals himself.

The drugs advised in this article may be given either (*a*) in capsule form by balling, (*b*) by means of a stomach tube, or (*c*) as a drench. Of these the use of a stomach tube is undoubtedly the safest. It ensures the passage of the full dose into the stomach without any risk of the drench entering the lungs. Carbontetrachloride should always be given in this way. A capsule breaking in the mouth or portion of a drench "going the wrong way" may be followed by serious and frequently fatal results. The passing of a stomach tube is not an easy operation for inexperienced hands, but most owners are conversant with balling and drenching. In the case of drenching the following points should be borne in mind:—

(1) Do not force the animal's head up too high. The head should be kept as near as possible to a horizontal position.

(2) Drench slowly and carefully.

(3) Do not continue should the horse struggle or cough; wait until he is quiet.

(4) Don't attempt to assist swallowing by holding the hand over the nostrils or tickling the throat.

Preparation for Treatment.—Horses to be treated for worms are previously starved. By a preliminary starvation, the amount of food in the gut is reduced and so permits the drug to make better contact with the worms. For the removal of worms from the stomach 18 to 24 hours' starvation is advisable, but for those worms in the large intestine it is necessary to starve up to 36 hours. This long period of starvation is well tolerated by animals in good condition. For debilitated animals it may be advisable to reduce it, but for best results against worms in the large bowel, the nearer the period of starvation to 36 hours the better. Water may be given during the pre-starvation period. It is also advisable to starve for a further 4 to 6 hours after treatment.

Preventive Measures.—Prevention of infestation is much more important in the control of parasitic diseases than medicinal treatment. While medicinal treatment may be depended upon to remove most of the worms and thus assist in promoting a return to good health, it is apparent that its value is considerably diminished if conditions are such that reinfestation can occur immediately afterwards. While medicinal treatment has its place in any well-considered plan of control, the use of drugs should be reduced to a minimum by employing preventive measures as much as possible. Prevention as it can be practised under normal farm conditions does not keep an animal entirely free from worms, but it does assist in maintaining the number of worms at such a low level that they cease to be of any importance. To this end the following recommendations are made. These are based upon a knowledge of the life histories of the parasites and of the various factors which assist in the development and survival of the free-living stages in the soil, water, and grass.

(I.) Undoubtedly, the chief source of infestation is the manure in which the eggs are passed. If one can prevent contamination of the horse's food with manure and also dispose of it in such a way that intermediate hosts—such as flies—cannot breed in it and so spread infection, very little infestation would take place. Manure cannot, unfortunately, be collected at regular intervals from pastures, but stables and yards can be kept clean. Thorough cleansing of stables is possible only when they have suitable floors. The disposal of the manure may present a problem, but there are several ways it can be treated so that flies are prevented from breeding in it—

(*a*) The manure, as it is collected, may be taken at once to farm land and there spread out as thinly as possible. It thus dries very rapidly and is unsuitable as a breeding medium for flies. During wet weather, however, this method may not be highly effective. Such lands, of course, should not be used for horses.

(*b*) If it is to be stored, it may be beaten into compact heaps with shovels. The heat of fermentation inside the heap kills any larvæ or eggs that may be there. The outer layers of the heap should be turned into the heap at frequent intervals.

(*c*) For large stables various types of fly traps have been devised, and of these, the South African Baber's fly trap is favoured. This trap is composed of four compartments, each large enough to hold a week's manure. The floor of each compartment is of concrete sloping towards each side and surrounded by a gutter filled with a suitable poison. The outer edges of the gutter should overhang slightly to prevent maggots from escaping. The walls of the compartment are built of strongly erected wire netting. The manure is packed as tightly as possible into each enclosure. Fly maggots in the centre are killed by the heat of fermentation, while those on the outer layers eventually drop into the gutter and are poisoned. The manure is left in each compartment for three weeks, when it is no longer attractive to the flies.

Horse manure is the most favoured breeding medium of the common house fly which is a notorious carrier of many diseases such as typhoid fever, infantile diarrhœa, tuberculosis, anthrax, and many others. Too much emphasis cannot therefore be given to the proper disposal of manure.

(II.) Feed-boxes should be raised above the ground, and hay should be fed in racks and not thrown on the ground.

(III.) Bedding should be changed frequently.

(IV.) Good clean water should be provided in troughs. Horses should not be permitted to drink from shallow, stagnant pools.

(V.) Swampy pastures should be avoided.

(VI.) One of the greatest sources of infestation is the permanent pasture. The longer a pasture is in use the more heavily contaminated does it become. By spelling a pasture for three months or more, the longer the better, most of the larvæ there die out. Such pastures whilst being spelled may be grazed by cattle or sheep, as the larvæ from worms infesting horses cannot infest these animals and *vice versa.*

(VII.) Do not overstock. The more horses there are in any given area the more heavily contaminated does it become and the greater the chances of infestation.

(VIII.) Some benefit may be accomplished in the decontamination of a pasture by burning. This, however, is not by any means as effective as spelling.

(IX.) Young animals are much more susceptible to infestation than mature animals. Keep the mares as free as possible by medicinal treatment and by applying the above preventive measures, and transfer the mares and foals to a pasture which has been cleansed by spelling.

(X.) Feed an adequate well-balanced ration. Animals which are well fed are more resistant to infestation and its effects than animals on a poor ration.

DIAGNOSIS OF PARASITIC INFESTATION.

Much can be learnt of the degree of infestation by a microscopical examination of the manure. For this purpose, however, the manure must be comparatively fresh, not more than 18 hours old when examined. This factor, unfortunately, does not permit the majority of horseowners any opportunity of submitting samples to a laboratory for examination. In such cases diagnosis must depend, therefore, chiefly on the presence of symptoms. Frequently, some information may be secured by roughly examining the manure, in which large roundworms, redworms, pinworms, and tapeworm segments are passed. Owing to the fact that best results depend upon the use of the correct drug, great care should be taken in making a diagnosis. Symptoms of parasitic infestation are dealt with in detail as each species of worm is considered. As a general guide, however, the following table is appended:—

Name of Worm.	Diagnosis.
Stomach Worms ..	General debility with a history of stomach disorders.
Tapeworms	Digestive disorders; general unthriftiness; blood in manure; tapeworm segments in manure.
Large Roundworms ..	Young animals mainly; stunted growth; rough coat; colic; cough; worms in manure.
Redworms	Emaciation; weakness, rough coat; membrances of mouth and eyes pale or white; manure soft or diarrhœric and evil smelling; colic; sometimes swellings on legs and abdomen; worms in manure.
Pinworms	Anal irritation; tail rubbing; creamy masses around anus; worms in manure and protruding from anus.

TAPEWORMS.

Tapeworms are flat and elongate in shape. At the anterior end of the body is a tiny head which is furnished with four suckers. Behind the head are a number of segments, which become progressively broader towards the posterior end. One interesting feature about tapeworms is the entire absence of a mouth and intestine, the food being absorbed through the body.

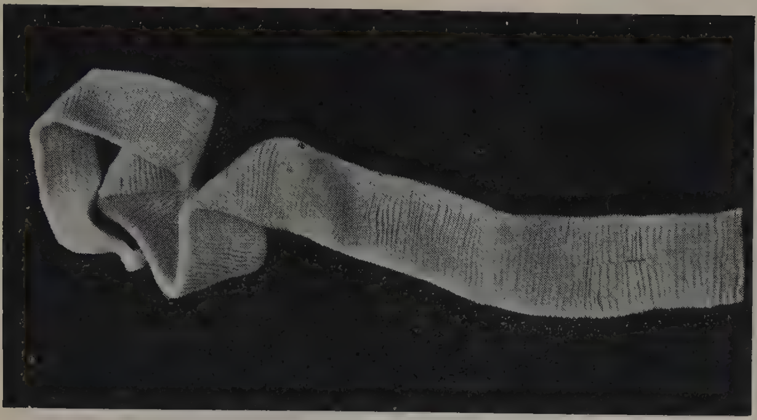


Plate 101.
The Large Tapeworm of the Horse (*Anoplocephala magna*). (Natural size.)

Tapeworms can complete their life-cycle only through the assistance of an intermediate host, such as an insect, a mite, or a slug. Each kind of tapeworm has its own special intermediate host or hosts.

Three different kinds of tapeworms are found in the horse. The largest and most common of these (*Anoplocephala magna*) (Plate 101) measures up to 30 inches in length and 1 inch in width. The smallest species (*Paranoplocephala mamillana*) measures ¼ inch to 2 inches in length; whilst the third species (*Anoplocephala perfoliata*) (Plate 102) is about 2 inches to 3 inches long. They are most frequently found in the small intestine, though *A. perfoliata* is of common occurrence in the large intestine also.

Their life history is unknown.

Plate 102.
The Lappetted Tapeworm of the Horse (*Anoplocephala perfoliata*).
(Natural size.)

Effect on the Horse.

Few tapeworms are of little consequence, but when the infestation is heavy they are said to cause general unthriftiness, rough coat, and digestive disorders. Probably the most important species is *A. perfoliata,* which is known to cause ulcers in the large intestine, wherever it attaches. The presence of this species may be suspected if the manure contains blood-stained mucous.

Treatment and Control.

Very little is known of treatment for tapeworms in horses, but the following alternatives are recommended. Starve twenty-four to thirty-six hours, then administer—

(1) 60 cubic centimetres of turpentine and 4 cubic centimetres of male fern extract in 2 pints raw linseed oil; or

(2) 30 grams kamala; or

(3) 30 to 45 grams freshly-ground areca nut; or

(4) 2 doses each of 3 drachms of tartar emetic in a gruel of linseed meal at an interval of twelve hours.

All the above doses are for a horse weighing about 1,000 lb. or more, and should be reduced accordingly for younger and lighter horses.

As the life histories of these tapeworms are unknown no special preventive measures can be recommended. Those measures already discussed should be carefully considered.

ROUNDWORMS.

Roundworms, as the name implies, are elongate, cylindrical worms; generally speaking, of the same shape as a pencil, though they taper at both extremeties. They are not segmented and are provided with a mouth and intestine. Most of them have a direct life-cycle—that is, infestation occurs by swallowing an egg or a larva, but some require an intermediate host, in much the same way as tapeworms.

THE LARGE STOMACH WORMS (*Habronema* spp.). (Plate 103.)

There are three speciees of large stomach worms—namely, *Habronema muscae, H. microstoma,* and *H. megastoma.* Both *H. muscae* and *H. microstoma* grow up to about an inch in length and are usually found lying along the stomach wall covered with a clear mucous. *H. megastoma* is only about half this size and occurs in nodules or tumours of varying sizes in the stomach wall.

Life History. (See Plate 100.)

These worms deposit eggs containing tiny larvæ in the stomach, which are eventually passed out in the manure. Before any further development can occur, the eggs must be swallowed by the maggots of certain species of flies which breed in horse manure. The larvæ are still present in the adult flies into which the maggots eventually transform. The larvæ then make their way into the proboscis or sucking organ of the flies, and when the flies feed on the moisture around the horse's mouth the larvæ break free from the proboscis into the mouth and are swallowed. Reaching the horse's stomach they settle down and grow to maturity. The horse can also, of course, become infested should it swallow flies containing larvæ.

Both *H. muscae* and *H. megastoma* may be spread by a number of different flies which breed in manure. The most important of these is the common house fly, *Musca domestica,* though in the bush most of the infestation occurs through the agency of the bush fly, *Musca vetustissima.* The third species of stomach worm, *H. microstoma,* is carried by the stable fly, *Stomoxys calcitrans.* This is the common biting fly everyone is familiar with owing to its preference for the lower parts of the body, such as the legs and ankles.

Plate 103.

Large Stomach Worms (*Habronema* spp.). (Natural size.)

Effect on the Horse.

The smallest species, *H. megastoma,* is the most serious, for it burrows into the stomach wall, destroys the gastric glands, and causes the formation of fibrous nodules. These nodules at times may be so numerous and so large as to interfere seriously with the passage of food. The other two species may, if sufficiently numerous, be responsible for severe irritation of the membrane lining the stomach.

The disease associated with these stomach worms is very common and very widespread. There do not appear to be any marked symptoms, but the continued interference with digestion ultimately leads to a general debilitated condition.

Should infested flies happen to feed on sores or moist places the larvæ are set free and burrow into the skin. As a result affected sores will not heal. In India, ''summer sores'' as they are called are extremely common and are regarded as serious. In Australia, growths in the corner of the eye and on the penis and sheath have been shown to have been brought about in this manner. ''Swamp cancer'' may be a similar condition.

Treatment and Control.

Owing to its location in nodules in the stomach wall there is no effective treatment for *H. megastoma.* The other two species, however, may be removed by treating with carbonbisulphide. The animal is starved for from eighteen to twenty-four hours. The stomach is then washed out with 8 to 10 quarts of a 2 per cent. solution of sodium bicarbonate. This removes the mucous in which the worms lie. The bicarbonate solution may then be siphoned off, or fifteen to twenty minutes allowed to elapse before giving the carbonbisulphide. This is given at the rate of 6 cubic centimetres for every 250 lb. of weight.

Carbontetrachloride as used against redworms is also recommended.

Control is only possible providing the manure is so stored as to prevent flies breeding in it. In stables, horses may be protected from flies by screening or by using sprays, lures, or traps.

For horses running on pasture one would have to rely chiefly on treatment as a means of control. One treatment should be given during the winter as soon as the flies have disappeared, another in early summer, and a third in the autumn.

THE SMALL STOMACH WORM (*Trichostrongylus axei*).

This is a very small and slender hair-like worm, no more than about ¼ inch in length. It occurs in the membrane lining the stomach wall.

Life History.

Eggs laid by the female worms are passed in the manure, and under suitable conditions of temperature and moisture eventually hatch to give rise to tiny larvæ. These larvæ undergo further development and finally reach a stage when they are capable of infecting the horse when swallowed. On reaching the stomach they settle down and grow to maturity.

Effect on the Horse.

The small stomach worm has been found in horses in Australia only recently, so its importance here is as yet unknown. In other countries heavy infestations are said to injure the stomach wall, causing masses of small nodules or areas which resemble ringworm in appearance. Such injuries are responsible for digestive troubles, leading to weakness and wasting.

Treatment and Control.

The carbonbisulphide treatment recommended for the large stomach worms should be used here also. Infestation may be prevented by applying the general measures already discussed.

THE LARGE ROUNDWORM (*Ascaris equorum*). (Plate 104.)

This is a large conspicuous worm, yellowish-white in colour and attaining up to 12 inches in length. The anterior end of the worm, usually spoken of as the head, is provided with three lips and is marked off from the rest of the body by a constriction. This species is most frequently found in the anterior half of the small intestine.

Life History. (See Plate 100.)

The eggs laid by the female worms reach the exterior in the dung. Under favourable conditions of temperature and moisture a larval worm appears inside the egg in about fourteen days, and in this stage the egg is ready to infect the horse. When swallowed the egg hatches in the intestine, and the tiny larva that is set free immediately bores into the intestine wall, reaches the blood vessels, and is carried to the liver. From the liver it is eventually taken to the lungs in the blood stream. After a certain period of development in the lungs, the larva then migrates into the trachea or windpipe, crawls up into the mouth, is swallowed, and reaches the small intestine again, where it settles down and grows to the adult stage.

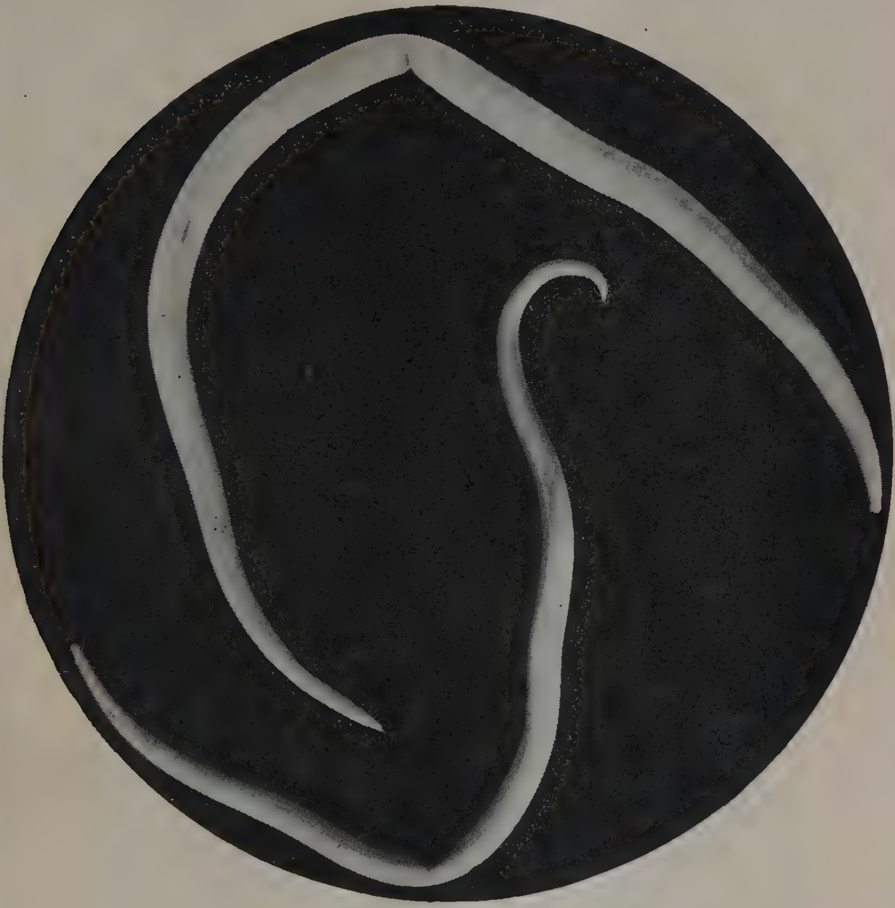


Plate 104.
THE LARGE ROUNDWORM (*Ascaris equorum*). (Natural size.)

Effect on the Horse.

The large roundworm is harmful chiefly to young animals, and heavy infestations may be responsible for general unthriftiness, stunted growth, rough coat, digestive troubles, and colic. These effects are due firstly to the damage caused to the liver and lungs by the migrating larvæ. Destruction of the lung tissue is particularly serious, as it may lead to pneumonia. The adult worms in the small intestine may be responsible for serious digestive troubles and sometimes by bunching together hinder the free passage of food. Cases are known of the intestine wall being ruptured as a result of this obstruction with fatal effects. Furthermore, the waste products given off by the worms are absorbed into the body. These products are poisonous, and as a result serious illness and even death may follow.

Treatment and Control.

The animal is starved for from 18 to 24 hours and then given either one of the following treatments:—

(1) Carbonbisulphide at the rate of 6 cubic centimetres for every 250 pounds of weight.

(2) Carbontetrachloride at the rate of 25 cubic centimetres for every 500 pounds of weight, given in 1 to 2 pints of liquid paraffin.

Of these two treatments, carbonbisulphide is the more efficient.

The eggs of this parasite are highly resistant to adverse conditions and capable of surviving for very long periods. Sanitation and the other principles of prevention already discussed should be enforced as strictly as possible.

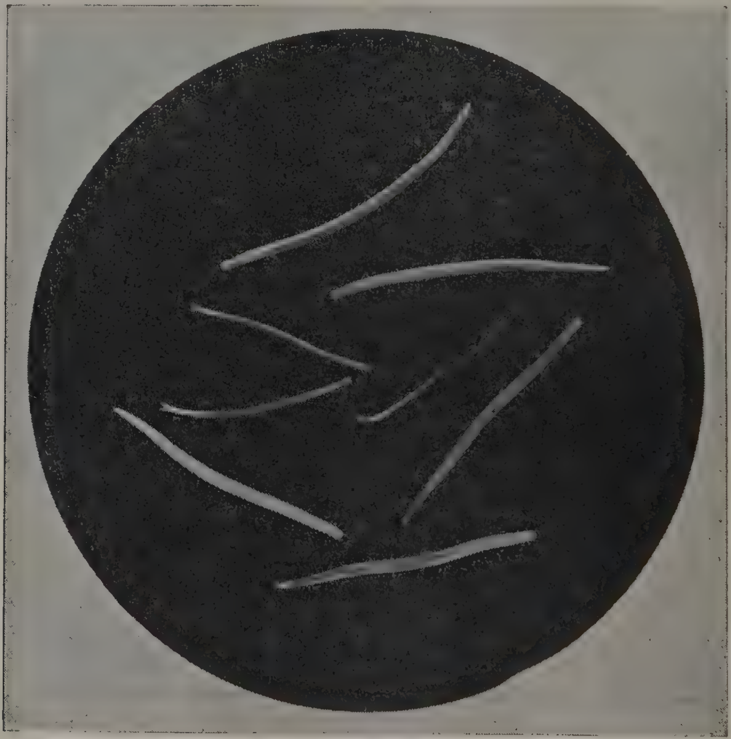


Plate 105.

REDWORMS (*Strongylus* spp.). (Natural size.)

RED WORMS (*Strongylus*). Plates 105 and 106.)

This name is given to a large number of different species of worms which are found in the large bowel and blind gut, many of which have a reddish colour. They vary in length from about half an inch to nearly 2 inches, and are the most common worms infesting the horse. The larger species (*Strongylus* spp.) (Plate 105) attach themselves firmly to the gut wall by means of their mouths, but the smaller worms (*Trichonema* spp. and others) (Plate 106) lie free in the gut contents.

Life History. (See Plate 100.)

The life history of all the species of red worms is only incompletely known. The initial stages, however, are similar for all. The eggs laid by the females pass out in the manure. If conditions of temperature and moisture are suitable, the eggs hatch in about a day. The larvæ that emerge undergo further development, and in about a week are ready to infest the horse. The infective larva, as it is called, is provided with an outer envelope or sheath which completely covers it and helps to protect it against such adverse conditions as dryness. These larvæ are capable of surviving for very long periods in a pasture, though the majority die in about three months. When the grass is wet with dew or rain, they are able to climb up the grass blades and are thus swallowed by the horse as it grazes. As might be expected, dull showery weather is particularly favourable to infestation.

Plate 106.

Redworms (*Trichonemidae*). (Natural size.)

After the larva is swallowed by the horse, the course followed by it within the horse's body depends upon the species of worm to which it belongs. In the case of the large species of *Strongylus*, the larvæ apparently migrate through the body and so may be found in later stages of development in such places as the liver, lung, spleen, pancreas, mesentery, certain lymph glands, and in the walls of various blood vessels. They eventually return to the large bowel along an unknown route, where they settle down and mature.

The larvæ of the smaller worms, on the other hand, burrow into the wall of the large bowel. They remain here for some time, eventually returning into the bowel and grow to the adult stage.

Effect on the Horse.

Redworm disease or strongylosis is probably the most common and most serious of all parasitic diseases affecting the horse, and is especially injurious to young animals. It is particularly prevalent in the coastal districts of this State.

The adults of the large species feed on the gut wall, causing serious injury. These worms suck blood and the injured gut wall may be attacked by bacteria. Some species cause the formation of ulcers. The loss of blood, in the case of a heavy infestation, is considerable, and as a result anaemia is a prominent symptom. In such instances, the mucous membranes of the eyes and mouth lose their healthy pink colour and are bleached white. The animal becomes very weak and swellings may be evident on the lower parts of the body. There is also extensive damage to the liver and other organs into which the larvæ may wander.

The larvæ of the smaller species when they burrow into the gut wall cause the formation of nodules. The presence of nodules and the accompanying damage to the gut lining brought about by the larger worms leads to serious digestive disorders. The manure becomes soft and evil smelling, and later diarrhœa becomes conspicuous. The appetite is diminished and in advanced cases may become depraved. As a result the animal loses condition rapidly and becomes very weak. The coat is rough and a pitiful, dull, dejected appearance is presented.

The larvæ of one species invade the walls of certain arteries, causing their walls to enlarge to such an extent that the flow of blood is interfered with. One of the favoured sites of these larvæ is in the walls of the artery supplying blood to the large bowel. As a result of the decreased blood supply, the large bowel becomes weakened and flabby and attacks of colic may be prevalent.

Long before any of the above symptoms become prominent, a heavy infestation may be suspected in any animal which shows a decreased capacity for work.

Treatment and Control.

The animal to be treated should be starved for up to 36 hours. It may then be given either one of the following treatments:—

(1) Oil of chenopodium at a dose rate of 4 cubic centimetres for every 250 pounds of weighs. This drug is given in 1 to 2 pints of raw linseed oil. Large doses of raw linseed oil cause superpurgation in some horses. This may be overcome by using equal parts of linseed oil and liquid paraffin. When employing oil of chenopodium, if the bowels have not moved within 24 hours, another dose of oil should be given. Oil of chenopodium should not be used for pregnant mares.

(2) Carbontetrachloride at a dose rate of 25 cubic centimetres for every 500 pounds of weight in 1 to 2 pints of liquid paraffin.

Animals which have been treated should be well fed for some few weeks afterwards until recovery is complete. It is advisable to mix ferrous sulphate with the feed at the rate of 2 grams daily in order to assist the animal to recover from the loss of blood.

While the above treatments may be depended upon to remove most of the worms from the large bowel, they have no effect upon the larvæ wandering in the body. A second treatment about three months later is then necessary in order to remove these worms after they have returned to the large bowel.

In areas of high rainfall, such as the coastal areas of Queensland, four treatments a year are recommended, in January, April, July, and October.

The preventive measures discussed earlier in this article if carried out will do much to keep the infestations small and obviate the necessity for frequent treatments.

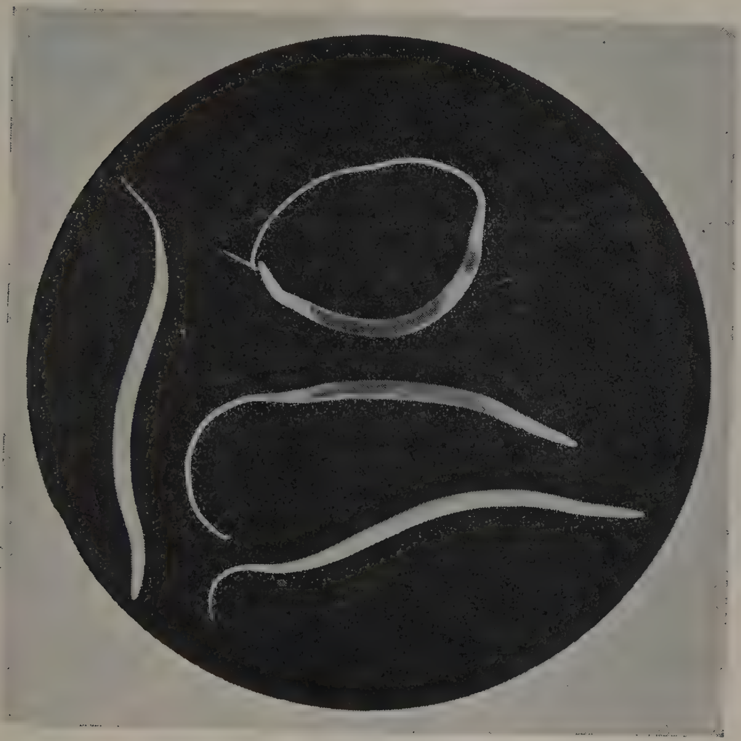


Plate 107.
PINWORMS (*Oxyuris equi*). (Natural size.)

PIN WORMS (*Oxyuris equi*). (Plate 107.)

These worms are a very common parasite of horses. They occur in the large bowel. The males and young females are whitish in colour. The female may be recognised by the pointed tail. Older mature females are greyish or brownish in colour and measure up to 6 inches in length, three-quarters of the body being occupied by a long narrow tail.

Life History.

When the female is mature, she wanders down the intestine and usually deposits her eggs in creamy-coloured clusters around the horse's anus. Sometimes she passes right out in the manure and lays her eggs there. A tiny larva develops inside the egg, but the egg does not hatch until swallowed by the horse. The larva, on being set free, then makes its way into the large bowel and grows to maturity.

Effect on the Horse.

The most noticeable symptom of pinworm infestation is the irritation caused by the female when she is depositing her eggs around the anus. The horse attempts to relieve the irritation by rubbing the base of the tail against any convenient object. It is also claimed that pinworms may be responsible for digestive disturbances.

Treatment and Control.

Treatment for pinworms involves the following steps:—

(1) An enema of strong quassia infusion to remove the mature females from the lower part of the bowel.

(2) The use of mercuric or carbolic ointment around the anus after washing away the egg clusters to relieve the irritation.

(3) A dose of oil of chenopodium as for redworms to remove the pinworms from the anterior portion of the large bowel.

The preventive measures already discussed should be enforced as much as possible.

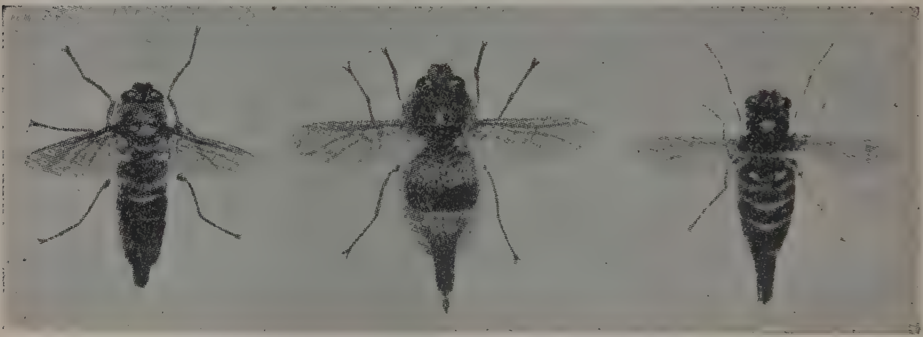


Plate 108.

ADULT BOTFLIES.—(*a*) The Common Botfly. (*b*) The Throat Botfly. (*c*) The Nose Botfly. (After Hadwen and Cameron.)

BOTFLIES AND BOTS.

There are three species of botflies known to attack the horse, the common botfly, *Gastrophilus intestinalis,* the throat botfly, *Gastrophilus nasalis,* and the nose botfly, *Gastrophilus haemorrhoidalis.*

The adults are all two-winged insects, bee-like in appearance, each species differing somewhat in colour markings, size and habits. The common botfly (Plate 108 (*a*)) is a brownish-grey species with mottled wings and a white face. The female deposits her eggs on the hairs of the mane, chest, shoulders, and legs, most usually on the long hairs of the forelegs, inside and below the knee. During egg-laying the female hovers around the animal, curving the abdomen beneath the body in order to facilitate the deposition of the eggs, each of which is laid and fastened to the hair in about a second. The position of the abdomen at the time of egg-laying has given the impression that the fly stings the horse, but this is erroneous. This species is apparently confined to Southern Queensland and is seen on the wing during the late summer and autumn.

The throat botfly (Plate 108 (*b*)) is somewhat smaller than the common botfly and has a reddish thorax and a prominent black band across the abdomen. The wings are clear. The eggs are deposited by the female on the hairs under the jaws. The female fly is usually seen hovering near or between the forelegs of the horse and then quickly darting at the throat to lay her eggs. One to four eggs may be laid at the one time, each attached singly to the hairs. The presence of this fly causes the animal to nod its head violently and sometimes to strike with the forelegs. This fly has a wide distribution throughout the State and is most prevalent during the late spring and early summer.

The nose botfly (Plate 108 (*c*)) is the smallest of the species under discussion, and chooses the hairs of the lips for egg-laying, particularly those hairs on the edge of the lip which are moistened by the saliva. The flight of the fly is very rapid, the insect darting at the lips to deposit a single egg and then withdrawing for a few seconds to repeat the process.

Plate 109.
Bots. (Natural size.)

Of these three species the throat botfly is most frequently seen in Queensland. The common botfly is not uncommon, but the nose botfly is regarded as being rare, if present at all.

As the mouth parts of the adult flies are rudimentary they cannot feed and are therefore comparatively short-lived. The common botfly has been known to live as long as twenty-one days, but the average life is not thought to extend much beyond a week. The two other species live only about three to twelve days, the throat botfly surviving the longer period.

Life History.

The Egg.—The eggs of these three botflies are glued to the hairs of the horse and differ considerably in shape, colour, and manner of attachment. The egg of the common botfly is yellowish in colour and is attached to the hair for about one-third of its length, the free portion of the egg forming an angle with the hair. Frequently more than one egg may be attached to a single hair, especially if the hair is long. The eggs do not hatch until they are rubbed or licked by the horse. The minute, spiny maggots are ready to hatch in about seven days, though they may remain unhatched and alive for months.

The eggs of the throat botfly are slightly different in shape to those of the common botfly and are fastened to the hair for about two-thirds of their length. These eggs do not require friction to cause hatching, which takes place normally.

The eggs of the nose botfly are black and stalked, the stalk being corkscrew-like and continued to the follicle from which the hair arises. Here, again, hatching does not require friction; the eggs nearest the moist edges of the lips hatch first, usually in five to six days, while those an inch away may take as long as eighteen days, and those some distance from the lips may not hatch at all.

The Larva or "Bot" (Plate 109).—On hatching, the larvæ of all species enter the mouth. They then bore their way beneath the membrane lining of the mouth and of the tongue, where they remain for some time, and eventually make their way to the stomach.

Once in the stomach, the larvæ or bots attach themselves to the wall by means of a pair of strong mouth hooks. The common bots are reddish in colour and are found attached to the white covering of the left sac and along the ridge between the right and left sacs. The larvæ of the throat botfly occur most usually near the pyloric or exit end of the stomach and in that portion of the intestine leading out of it. Those of the nose botfly may occur attached to various parts of the stomach, but are more usually located near the pyloric end. Bots are all provided with rows of spines on the anterior border of the majority of the segments, the number and arrangement of the spines differing in each species. After living in the stomach for about eight to twelve months they are fully grown and are passed out with the dung. Those of the common botfly and throat botfly pass out without any reattachment; but in the case of the nose botfly the larvæ fasten themselves to the rectum and again to the anus before they finally reach the ground.

The Pupa.—As soon as they reach the ground the bots at once commence to seek some protection. However, they do not crawl very far, and burrow into the soil only a short distance. In one to four days the outer skin hardens and forms a protective coat, known as the puparium, inside which the transformation from the bot to the adult fly takes place. The puparium is brown to black in colour, but is otherwise similar to the bot. At the end of about three to ten weeks the transformation is complete, and the adult fly emerges.

Injuries Caused by Botflies.

Possibly the greatest damage among horses through botfly presence is self-inflicted. Extreme annoyance and worry is caused during egg-laying by the females, as the horse recognises its enemy and makes desperate efforts to protect itself.

The common botfly appears the least irritating of the three species, probably because of the varied situations in which its eggs are deposited. Even so, its presence keeps the animals in a continuous state of annoyance and prevents them from resting. The throat botfly causes the animal to throw its head about violently, and makes it difficult to manage in harness. The nose botfly appears to be the most annoying species, for the insect in depositing its eggs on the hairs of the lips causes a severely irritating tickling. The actions of horses while the insects are about are very characteristic. The throat botfly causes them to stand together with their heads over each other's back, and if the nose fly is about they protect their lips by placing them against each other's body.

Should the insects be numerous, and the protections abovementioned be inadequate, the animals keep up a continuous movement, occasionally breaking into a gallop, in attempts to prevent the insects alighting and laying eggs.

It is commonly considered that the bots in the stomach are of little importance. It should be remembered, however, that the larvæ are developing for from eight to twelve months in the horse's stomach, and during this period considerable harm may be done. The spiny armature and the large mouth hooks cause inflammation of those parts with which they may come into contact, which results in an interference with digestion. Large numbers of bots may bring about obstructions and seriously interfere with the passage of food. The nature of the food taken in by bots is not known, but they certainly live at the expense of the horse, and the pinkish hue of some of the larvæ suggests that they may be blood suckers. As a result of heavy infestations the horse may eventually become markedly debilitated.

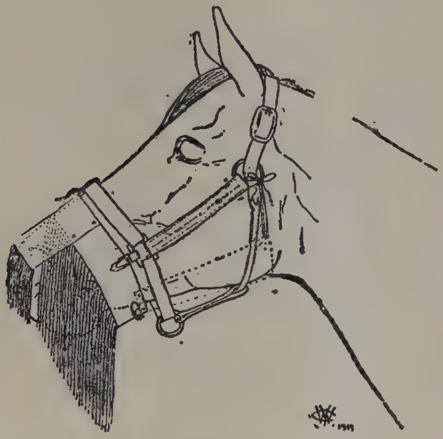


Plate 110.
Leather Nose-Fringe as Protection against the Nose Botfly.
(After Hadwen and Cameron.)

Protection and Treatment.

Various devices have been recommended for the protection of the horse against botfly attack. For the throat botfly a piece of ordinary canvas attached to the nose band and tied to the headstall will completely cover the region between the jaws. As protection against the nose botfly, the Canadian authorities recommend a leather band cut into thin strips and encircling the nose (Plate 110). In the United States good results have followed the use of a mouth guard constructed from ½-inch hardwood boards. For protection against the throat and nose flies it is recommended that the throat be covered by a piece of canvas which is attached in front to the wooden mouth protector (Plate 111). Furthermore, this combination device is said to prevent the animal from taking into the mouth the larvæ of the common botfly while attempting to bite or scratch itself. The hardwood guard completely protects the lips when the head is up, and the block beneath causes the guard to fall back when the head is lowered, and does not interfere in any way with the animal's grazing.

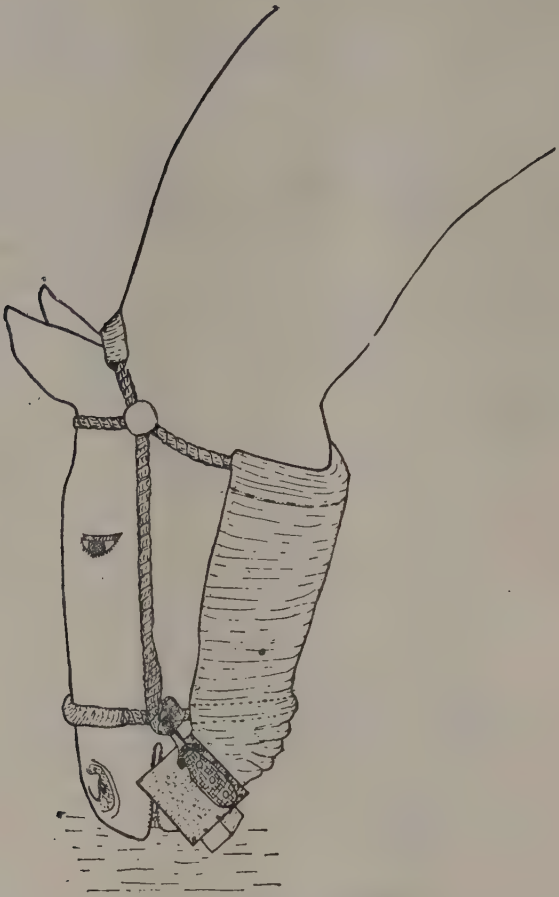


Plate 111.

DEVICE FOR PROTECTION AGAINST THE THROAT AND NOSE BOTFLIES.
(After Hadwen and Cameron.)

Another effective protector for use against the nose botfly when the horse is in harness consists of a piece of leather 4 to 6 inches wide attached at each side to the bit ring so that the entire lips are covered.

As the eggs of the common bot are not confined to any particular region of the horse, it is difficult to recommend any good means of protection. In other parts of the world the provision of deep sheds or brush shelters is said to give some protection, for when the flies are bad the animals may retire into the sheds, into the shady interior of which the flies will not venture.

Frequent grooming and clipping of the hairs of the areas on which eggs are laid will aid in control. The eggs of the common botfly may be destroyed simply by washing them with water heated to about 120° F. This treatment, however, is not effective against eggs of the throat botfly or nose botfly, and here it is necessary to use a 2 per cent. carbolic wash.

For the removal of the bots from the stomach, carbon bisulphide will be found very efficient. The animal should be fasted for from eighteen to twenty-four hours before treatment. The drug is given in a capsule or by stomach tube, the dose rate being six cubic centimetres for every 250 lb. weight, horses of 1,000 lb. weight or more therefore requiring a dose of twenty-four cubic centimetres. No food or water should be given for three or four hours after treatment. For best results treatment should be given each year about June. At this time, egg-laying has ceased and the larvæ migrating in the tissues of the mouth have all reached the stomach. Before treatment it is wise to destroy any eggs which may not have hatched by the measures mentioned above.

EXTERNAL PARASITES.

The term external parasites includes all those parasites which live and obtain their food on the body surface. The term is a very broad one, and takes into consideration not only those forms which live permanently on the skin, such as lice and mange mites, but also many others, such as the mosquitoes, march flies, and sandflies, which visit the animal only when they require food.

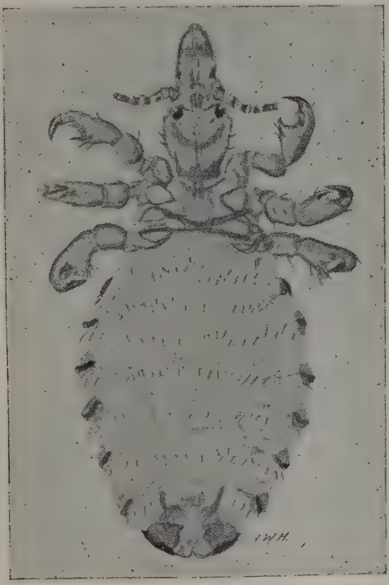


Plate 112.
Haematopinus asini × 24.

External parasites are capable of causing harm in many ways. They pester and irritate their hosts, permitting it to neither feed nor rest sufficiently for normal growth. Some species are capable of abstracting considerable amounts of blood, and many of them, particularly those species which feed on blood, transmit serious diseases.

Horses in Queensland act as hosts to many different kinds of external parasites. Mosquitoes, sandflies, march flies, and stable flies all extract their toll, but, in general, are not as serious as the more permanent forms, such as the lice and mange mites.

LICE.

Three different kinds of lice are found on the horse. The largest species is the sucking louse, *Hæmatopinus asini* (Plate 112). This louse is yellowish-brown in colour, and measures about ⅛ in. in length. The head is long and narrow and terminates in a blunt point. Sucking lice live on blood and other body fluids, which they obtain by piercing the skin with their mouthparts. The other two species of lice are biting lice. They are very similar in appearance to each other, each having a broad flat head only slightly longer than broad and semi-circular in front. Their technical names are *Bovicola equi* (Plate 113) and *Bovicola pilosus*. These biting lice live on scales, scurf, and other débris on the animal's skin. Sucking lice are most common on the neck, flanks, and under the jaw, while biting lice prefer the regions at the roots of the mane and butt of the tail. In heavy infestations, lice may occur anywhere on the body.

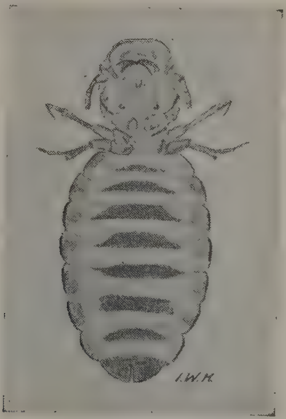


Plate 113.
Bovicola equi × 24.

Life History.

The life histories of all lice follow the same general lines, and differ only in detail. The female louse lays eggs which she attaches by means of a sticky secretion to the hairs of the animal's coat. The eggs hatch in time, and from each of them emerges a tiny louse which differs from its parents chiefly in size. These tiny lice gradually grow, passing through different stages of growth, each of which is preceded by a moult or casting of the skin, until they reach the adult stage.

The eggs of the sucking louse of the horse hatch in twelve to fourteen days. In another eleven to twelve days the young lice are mature, and if females commence laying eggs. The eggs of the biting lice hatch in eight to ten days.

Effect on the Horse.

One has only to watch a heavily infested horse to understand how irritating and annoying these pests can be. The animal will rub, scratch, and bite in an attempt to relieve the irritation. The hair is damaged and falls out, and the skin becomes bruised and broken.

Lice are most prevalent during periods when the animal's condition is poor and its vitality is low. Such may be due to disease, or simply brought about through the pastures drying-off and losing their nutritive value, as they do in this State in the late winter and early spring or in times of drought. Horses which are stabled for any length of time and not groomed or exercised also frequently become heavily infested.

Treatment and Control.

Lice are spread chiefly by contact, but it must be remembered that clean animals can become infested through the careless use of harness, currycombs, blankets, &c. As sucking lice may remain alive off the horse for two or three days, and detached eggs may retain their vitality as long as twenty days, there is also a possibility that an infestation may be picked up in stables which have housed lousy horses. Control measures therefore involve—

(1) Treatment of infested animals to kill the lice infesting them. Biting lice may be eliminated by washing or spraying with arsenical cattle dip. This treatment is, however, not very effective against sucking lice, and for these it is necessary to employ a solution of nicotine sulphate (40 per cent. nicotine) at the rate of two teaspoonfuls of nicotine sulphate to one gallon of water. This nicotine sulphate solution is also very effective against biting lice. Oils such as Diesel oil and sump oil are also very effective, but the horse's skin is not very tolerant to such oils, and blistering may result.

The fluids mentioned above, whilst effective against lice, do not kill all the eggs. A second treatment is therefore necessary in order to eradicate any lice that hatch from the eggs that survive. Best results will be secured if the interval between the two treatments is fourteen to sixteen days.

(2) Disinfect all harness, brushes, &c., used on infested horses.

(3) Clean out the stables thoroughly and wash them out with a strong disinfectant solution.

MANGE.

Horses are subject to three different types of mange—namely, sarcoptic mange, psoroptic mange, and chorioptic or foot mange. These diseases are brought about by tiny mites which attack the skin, causing severe irritation, as a result of which the hair falls out and the skin becomes thickened, leathery, and covered with crusts or scales.

Neither sarcoptic nor psoroptic mange occur in Queensland. There exists, however, a skin disease known as Queensland itch, which closely resembles psoroptic mange. This itch usually commences at the root of the mane and butt of the tail, and from there spreads to other parts of the body. Its cause is not known.

CHORIOPTIC OR FOOT MANGE (*Chorioptic equi*).

Foot mange is by no means uncommon, particularly among stabled horses. As its common name implies, it is confined principally to the lower portions of the limbs. The mite responsible for this mange is very tiny, measuring at most about one-fiftieth of an inch in length. (Plate 114 (A) and (B).) This parasite lives on the skin surface, which it punctures to obtain its food. This results in inflammation and the formation of papules. Eventually the affected area loses its hair and becomes thickened and leathery and covered with crusts.

Effect on the Horse.

The irritation causes the horse to rub, bite, and stamp the affected parts. An otherwise docile horse may suddenly become restless and kick for no apparent reason. Some authorities regard foot mange as of primary importance, as they consider that the stamping and kicking may lead to serious injury to the limbs, thus shortening an animal's working life.

Plate 114.

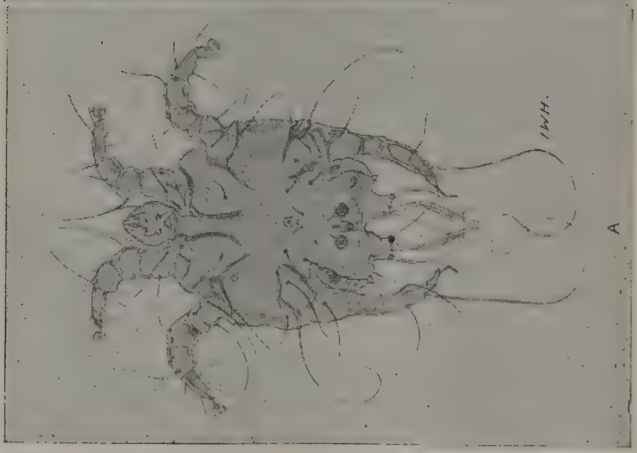


Fig. A. *Chorioptes equi* × 100. Male.

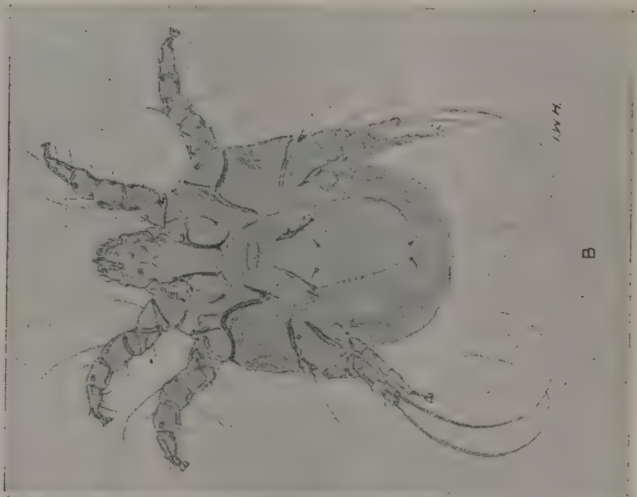


Fig. B. *Chorioptes equi* × 100. Female.

Treatment and Control.

The affected limbs should be clipped and bathed in the nicotine sulphate solution recommended for lice or in a warm lime sulphur solution. The clippings should be burnt and treatment repeated every ten days until recovery is complete. Sump oil or crude oil may also be employed against foot mange. Oils, however, are inclined to remove the hair and blister, so must be applied very carefully. Brushes, &c., used on infested horses should be disinfected, and stables should similarly be treated.

To make an efficient lime sulphur solution, take 1 lb. of slaked lime and 1½ lb. flowers of sulphur. Add sufficient water to the lime to make a thin paste, then sift in the sulphur, stirring and, if necessary, add water till a mixture of the consistency of mortar is secured. Pour into this mixture about 2 gallons of boiling water, and boil until the sulphur disappears from the surface, keeping the mixture well stirred. When the mixture becomes a dark amber or chocolate colour (about two to three hours) the boiling should be discontinued, and the contents allowed to stand till clear. Pour off the clear liquid to which is added sufficient warm water to make 6 gallons. Before using, seven parts of warm water should be added to every three of the prepared concentrate.

◆

A CHANGING AGRICULTURE—ELECTRICITY ON THE FARM.

In every country in the world agriculture is changing in a remarkable way, as an effect of the application of new forms of machinery and of new discoveries in agricultural science. But from a technical point of view, perhaps, one of the most remarkable developments is the application of electricity to farming in an ever widening field. Under these technical influences, the whole character of agriculture is changing increasingly and to an extent which in time will certainly modify the whole structure of rural life.

Until very recently the power required on the farm was practically limited to man power and animal power. The internal combustion engine is undoubtedly a chief factor in this technical development. Then comes electricity, by which has been demonstrated what can be done with a fixed source of power. Where natural water power is available, there we have the gradually extending electrification of the farm. A notable instance of this is the Nymboida electricity supply scheme in New South Wales. Many farms in the surrounding district are now served by electric light and power through the development of this scheme, and what that means in a dairying district, like the Northern Rivers of New South Wales, is easily realisable.

Rural electrification has reached a very high level in European countries, notably Belgium, Denmark, Holland, and Switzerland. New Zealand also is well in the van of this development.

Electricity is acquiring an increasing importance in the supply of power for irrigation. Where irrigation cannot be made a permanent practice by using the natural slope of the land, and where water must be lifted, the electric motor has proved itself better than all others for driving a pump.

Electric dairy equipment has already become a commonplace in many countries, and it has the advantage over all other types of power because of its simplicity and cleanliness. Electrically charged fences also are becoming common, likewise the use of electricity on the poultry farm for brooders and incubators. In many countries threshing is done by electricity. Attempts also are being made to develop the use of electric ploughs.

In the farm home, electricity is lightening the drudgery of domestic work. In fact, no scientific advance is more capable of changing the whole domestic outlook so effectively as electricity.

In combination with modern transport and better rural roads, electricity with its wide range of technical application is already lessening the differences between town and country, and may even be destined to be the chief influence in a movement back to the land.

Fused Needle Disease and its Relation to the Nutrition of Pinus.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

(Continued from p. 315, *March,* 1940.)

PART B.—THE MYCORHIZAL THEORY REGARDING THE CAUSE OF FUSED NEEELE DISEASE.

I. INTRODUCTION.

REFERENCE was made in Part A of this paper to the early consideration of the hypothesis that some upset in the mycorhizal equipment of the pine tree was probably responsible for the fused needle condition. As a result much of the experimental work was planned from this point of view. The idea had its origin in the close correlation which was noted between the occurrence of fused needle disease and the presence of abnormal mycorhizas on the trees. From observations and experiments carried out chiefly at Beerwah, and a general survey of the available literature on mycotrophy, a scheme of investigation was drawn up and the experiments described in Part A carried out. As a general working hypothesis it was thought that, if suitable conditions for mycorhiza formation were made available, the trees would be provided with satisfactory growth conditions, and physiological upsets such as fused needle and its related symptoms would not appear. In order to determine the factors necessary for the satisfactory development of healthy mycorhizas a survey of the knowledge available concerning the subject had to be made, as well as of the conditions in healthy and unhealthy pine plantations.

The survey indicated that an essential factor in the development of plantations of *Pinus* in Queensland is the presence of a suitable supply of raw organic matter. The significance of this factor in the growth of a healthy pine tree was deduced partly from direct experimental work and partly from the available literature as being connected with the supply of carbohydrate material to the tree through its root system. The carbohydrate is obtained from the breakdown of the organic matter in the plant débris, in and on the soil surface, by the mycorhizal fungi in the course of their normal metabolism. The presence of a mycorhizal complex on the roots of the pine tree thus allows the tree access to this carbohydrate supply. The fact that this aspect of the significance of mycotrophy in *Pinus* has hitherto escaped general recognition is surprising when one considers the saprophytic nature of the fungi concerned. The other aspects of mycotrophic significance which are now generally accepted—that is, the supply of nitrogenous materials and inorganic salts by the mycorhizal complex—are not contradicted. It is considered, however, that this view should be modified so as to include the carbohydrate hypothesis herein discussed.

The results achieved by phosphate applications can be satisfactorily explained by this theory, as can the occurrence and successful treatment of fused needle disease.

The mycotrophic habit of plants is by no means a modern discovery, although the understanding of the relationship between the fungus and the plant root has been considerably widened by the advances made during the present century. Adequate historical résumés of the development of this habit have been made by Rayner (1927) and Hatch (1937), but for the purpose of clarifying the concept embodied in this paper it is considered that the salient points in the literature which are relevant to the present investigations should be briefly mentioned. These points are classified in two sections; one deals with the morphology and distribution of mycorhizas and the other with their physiological rôle.

II. THE MORPHOLOGY AND DISTRIBUTION OF MYCORHIZAS.

The generally accepted concept of the absorbing system of a plant does not portray the actual conditions which prevail in the case of the majority of forest tree species and the same statement is becoming true of an increasing number of other plants. The usual text-book description gives a picture of growing root tips protected by root caps as they push through the soil. The younger portions of these roots bear numerous fine root hairs growing out from the surface for some distance back from the tip. These root hairs are generally looked upon as the normal absorptive organs in the typical terrestrial plant. In woodland trees, however, the feeding roots are found to be normally invaded by fungi, and in many cases the root hairs are entirely absent and the walls of the root tips are so radically altered that the roots have no direct contact with the soil. The surface of the root ends, through which normal absorption takes place, is often completely enveloped in a sheathing mantle of wefted fungus mycelium which covers not only the lateral portion of the root but the tip also, and the absorption of soil nutrients has to take place by means of complex exchange processes between the fungus and the higher plant. The nutrients are first taken up in solution by the fungus mycelium which branches out from the mantle into the soil. From these hyphae the nutrient solution is conducted through the mantle and into or between the cells of the root cortex, which are enclosed by a continuous network, the ''Hartig net,'' of mycelium. This structure, which comprises plant root and fungus mycelium, is called a mycorhiza, signifying a fungus root, and the mycorhizal method of plant nutrition is known as mycotrophy (Stahl, 1900).

One of the earliest records of the existence of the mycorhizal partnership was made by Theophrastus (372-287 B.C., cf. Kelley, 1937), who noted the presence of the fungus on and near the roots of oaks and other forest trees. Since this time numerous observations on the occurrence of fungus roots have been made, but it was not until the development of microscopic technique occurred that any real study of the relationship was possible. Numerous authors in the latter half of the nineteenth century have made note of the phenomenon.

The first accurate account of the association of a fungus mycelium with the root cells of a higher plant to form the structures known as mycorhizas was made by Reissek in 1847 (cf. Rayner, 1927). In the early period of investigation the majority of the observations were made on orchid roots, and in particular on the roots of those orchids which do not produce chlorophyll—that is, the so-called holosaprophytic orchids such as *Neottia* sp.

The older writers, including the elder Hartig, did not recognize the presence of the fungus as such in what are now known to be mycorhizal roots, but considered it to be an unexplained part of the root's anatomy. The intercellular mycelial network which now bears Hartig's name was

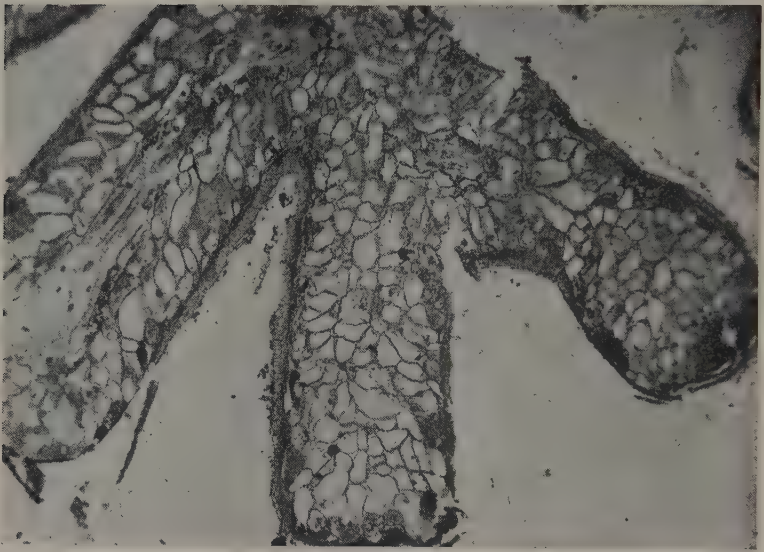


Plate 115.

LONGITUDINAL SECTION THROUGH A NORMAL ECTOTROPHIC CORALLOID MYCORHIZA OF *Pinus tæda.*—Showing the fungus mantle and general structure. (× 70.)

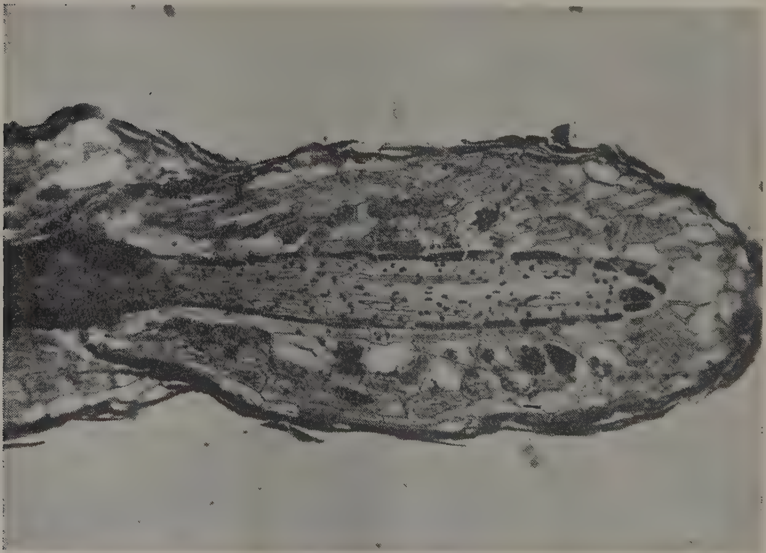


Plate 116.

LONGITUDINAL SECTION THROUGH AN ENDOTROPHIC MYCORHIZA OF HOOP PINE (*Araucaria cunninghamii*).—Showing arbuscules and sporangioles. (× 70.)

thought by him to be a normal part of the root. However, he noted the infrequency of the occurrence of root hairs in forest trees, a phenomenon which was later observed by many others and has now come to be associated with the development of a mycorhizal system.

The knowledge of mycorhiza in the light of a mutualistic relationship really dates from the year 1881, when Kamienski published the results of detailed researches on the roots of plants which showed a constant and peculiar fungal infection. Kamienski was followed by Frank (1885), who contributed largely to the discussion and invented the term "mykorhiza" to describe the fungus root partnership. Frank and his school of workers carried out definite researches on this subject, and their findings led to the recognition of root infection in vascular plants as a constant and common phenomenon. Since this period the work has been continued without interruption until the present day. Later work has been distinguished by the application of modern technique to the elucidation of the problem.

Frank, in 1887, published a classification of the types of mycorhizas in which the two main divisions, ectotrophic and endotrophic, appear and these terms have remained in general use since that time. In the *ectotrophic* form (Plate 115) the fungus constitutes a mantle on the surface of the organ and is also distributed as a Hartig network (Plate 119), consisting of intercellular hyphae in the cortex of the root. The hyphae of the Hartig net are continuous with those of the mantle. In the *endotrophic* form (Plates 116 and 117) the fungus mycelium is typically intracellular in the cortical root cells and the mantle is not present although individual hyphae connect the intracellular structures with the exterior of the root and mycelium in the soil. Ectotrophic mycorhizas are found in the Cupuliferae and Pinaceae, whilst the endotrophic type has been observed in most other plants which have been examined for the presence of mycorhizas. The difference between the two types of mycorhizas is now known to be one of degree rather than of quality. They merge into one another and many intermediate forms are now known. The intermediate forms are said to belong to the ectendotrophic type. Before Frank's time the ectotrophic mycorhizas were considered to be the normal type, but later investigations have shown them to be less common than the endotrophic mycorhizas, typical examples of which occur in the orchids, heaths, and the hoop and bunya pines (*Araucaria cunninghamii* and *Araucaria bidwilli*). It has been shown by the writer (Young, 1940) that the fungus *Boletus granulatus* forms endotrophic mycorhizas with *Araucaria* and ectotrophic ones with *Pinus*. This indicates that the type of mycorhiza formed is determined by the host plant rather than by the fungal associate.

Janse (1897, cf. Kelley, 1937) studied the morphology of mycorhizas in greater detail than did his predecessors and called attention to the terminal swellings, which appear on the hyphae of the endophytic fungi soon after infection and to which he gave the name "vésicules." He observed that they are filled with food products and considered them to be the resting spores of the fungus. The vesicles are of common occurrence on the roots of most plants with endotrophic mycorhizas except the orchids. They are formed both within the cells and in the intercellular spaces and contain much granular material and oil. Shibata (1902, cf. Rayner 1927) regarded the vesicles as being comparable with the swellings formed on vegetative hyphae in culture. The generally accepted viewpoint is that they are vegetative storage organs.

Another type of organ found in an endotrophic mycorhiza is the "arbuscule." This term was applied by Gallaud (1905), who observed that the hyphae in the intercellular spaces sometimes repeatedly branched and that this phenomenon occurred even more frequently within the cells. This branching produces the characteristic bodies in the cells, which vary in detail according to the plant in which they occur. They are terminal structures on the main hyphae. Gallaud considered the arbuscles to be haustorial branch systems which act as absorbing organs for the fungus.

In some cells Gallaud noted the presence of granular masses which have no definite hyphal structure; they are always intracellular and usually occur in the deeper cells of the cortex of the mycorhizas. He convincingly demonstrated that these bodies are degenerated arbuscules in process of intracellular digestion by the roots of the higher plant. He found them to be identical with structures previously observed by Janse and which had been called "sporangioles" by him. Gallaud retained this term for them.

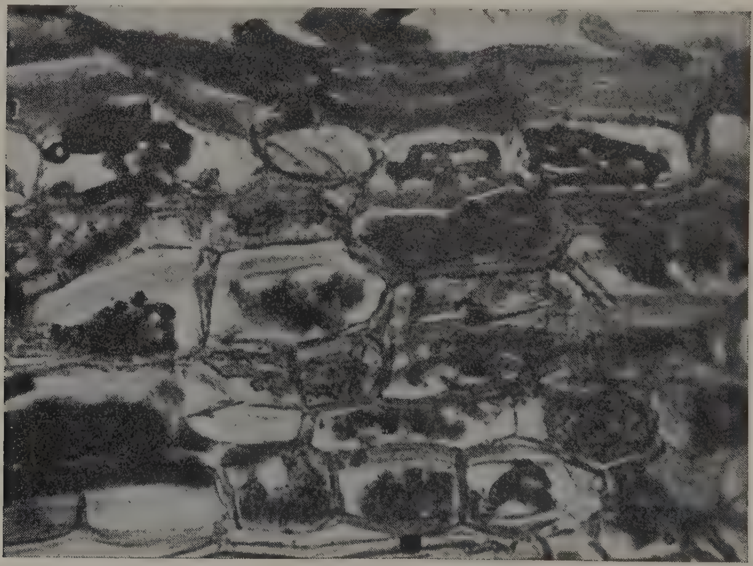


Plate 117.

LONGITUDINAL SECTION THROUGH AN ENDOTROPHIC MYCORHIZA OF HOOP PINE.—Showing detail of arbuscules and sporangioles. The root surface is seen at the top of the photograph with the arbuscules in the outer cortex and the sporangioles further in. (× 350).

Concurrently with the recognition of the normal association of fungi with the roots of forest trees, the apparent relationship of the sporophores of certain fungi to particular tree species had gained general notice. This was particularly so in the case of the occurrence of the truffle in beech forests in Europe and culminated in the employment of Frank in Germany in 1885 to investigate this phenomenon with the object of increasing the production of the fungus. His researches did not succeed in evolving a method for augmenting the truffle crop, but showed that the Cupuliferae are normally and constantly mycotrophic as regards root development. All their short roots are normally mycorhizal.

The nature of the fungi found associated with particular species was given considerable attention during the period of Frank's influence and a number of fungi were, by observational methods, connected with the occurrence of mycorhizas on particular trees, orchids, and other plants without, however, providing any great amount of sound evidence for the conclusions.

At the same time, the list of plants known to be mycotrophic was greatly extended. Johow (1885, 1889, c.f. Rayner, 1927) recorded the presence of mycorhizas in all but one species of the forty-three genera of nonchlorophyllous and nonparasitic phanerogams which he examined, and showed that the mycorhizas in these saprophytic plants were chiefly of the endotrophic type.

In 1894 Groom described the morphology and histology of several holosaprophytic orchids from Indo-Malaya and noted extensive endotrophic fungal infection in the rhizomes and scales. Numerous other observations on the occurrence and form of mycorhizas on nonchlorophyllous orchids chiefly belonging to the genus *Corallorhiza* were made about this time by various authors. In 1897 Janse (c.f. Kelley, 1939) extended the list of mycorhizal plants by recording root infections among seventy-five tropical species which he studied; of these, sixty-nine showed typical endophytic infection without causing damage to the host cells.

Hesselman, in 1900 (c.f. Melin, 1925), recorded mycorhizas in a number of arctic plants growing in poor soils with low amounts of humus and Wulff (1902, c.f. Rayner, 1927) reported mycorhizas in many arctic species, all of which were characterized by the presence of abundant sugar and little starch in the leaves and exhibited feeble transpiration streams.

During the present century numerous additions have been made to the list of fungus species associated with mycorhiza formation in various trees. The main evidence for the inclusion of the majority of the species was the occurrence and the regular association of particular sporophores with the trees concerned and on the continuity of the sporophore mycelium with the mycorhizal structures. Other evidence used was the similarity of the mycelium in the mantle and that in the fructification. In recent work, however, a considerable number of species of fungi and higher plants have been definitely shown to be related by means of pure culture synthesis of mycorhizas.

Melin (1925) synthesized mycorhizas in pure culture of *Boletus luteus* and *Pinus sylvestris,* and also of *Boletus elegans* with *Larix europaea.* He also experimentally demonstrated the formation of mycorhizas by *Boletus, Tricholoma,* and *Amanita,* and added *Cortinarius, Lactarius,* and *Russula* on birch and aspen to the experimentally proved list of mycorhizal forms.

Syntheses of mycorhizas of *Pinus* with pure cultures of *Rhizopogon* (Plate 118) and *Boletus* have been made by the writer (Young, 1936, 1937).

The work carried out by Melin (1917-1925) signalized a marked advance in the knowledge of ectotrophic mycorhizas. He was able to distinguish between true and pseudo-mycorhizas. In conifers the latter type was found to be thinner and simpler than the normal one, and to be due to a parasitic infection of the short roots by a fungus different from that forming a normal mycorhiza. Melin showed that root infection by fungi to form mycorhizas takes place through the root hairs and epidermal cells. After infection the root hairs are often discarded. He showed anatomically that the higher plant was benefited and not harmed by the presence of the normal fungus associate.

Three types of ectotrophic mycorhizas were described by Melin; (*a*) coralloid (gabelmykorhiza); (*b*) tuberculate (knollenmykorhiza); and (*c*) simple (einfach). The coralloid type is that usually found in pine and consists of branched short roots produced laterally and terminally on the finer roots, and has a coralloid or witches' broom appearance. The tuberculate form consists of small tuberous structures so crowded that they often grow together. The tuberous character of these is due to the wefting together into one structure of a cluster of dichotomously branched short roots by the fusion of the fungus mantles. The simple form consists of a single mycorhizal short root which is often much longer and finer than the preceding types. In some cases the simple type is a stage in the development of one of the others. The colour of the mycorhizas varies with age and with the species of fungus forming the mantle.

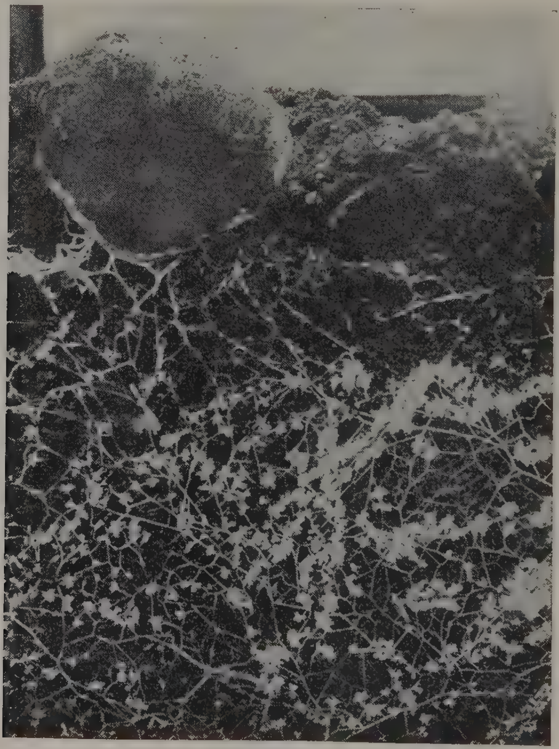


Plate 118.

SPOROPHORE OF *Rhizopogon roseolus* IN ASSOCIATION WITH THE ROOTS OF *Pinus taeda* IN PURE CULTURE.—Showing coralloid ectotrophic mycorhizas and connecting mycelial strands (natural size).

It was later shown by Hatch (1933) that the short roots involved in mycorhiza formation were not roots which had been limited in growth owing to fungus infection, as had previously been assumed. On the contrary, the infected roots are roots of determinate growth—that is, "short" roots which would not grow longer even if not infected. Infection, however, often stimulated branching and swelling. The production of these short roots appeared to be a normal development in trees possessing the mycotrophic habit.

III. THE PHYSIOLOGICAL RÔLE OF MYCORHIZAS.

Previous to Frank's time the significance of the relationship between fungus and root was either unappreciated or was just becoming a subject for argument, and from that period up to the present time much controversy has been and continues to be carried on concerning the rôle played by the two symbionts in mycorhizas. Frank and his colleagues carried out definite researches and experiments into the physiological significance of the mycotrophic habit, and their work has been followed up by later investigators.

The constant occurrence of mycorhizas on woodland trees led Frank to the conclusion that all water and nutrients which were absorbed by the fungus-sheathed roots must be obtained by the tree from the fungus. He also directed attention to the fact that, in both the Cupuliferae and the Ericaceae, the occurrence of mycorhizas was dependent upon the presence of abundant humus and was not dependent on other soil conditions. This humus was derived from fallen leaves and other material from plants growing in the soil in question. He showed experimentally that humus from other than woodland sources was unsatisfactory and that trees planted in soils with this type of humus failed to develop mycorhizas. He concluded that the normal health of forest trees is dependent on supplies of woodland humus. This allowed satisfactory mycorhizal development, without which they could not obtain their proper nutrients. It is possible, of course, that the right type of fungus for the particular trees used in the experiments was not present in the soil obtained from outside sources. On the other hand, from work carried out by Rayner (1934, 1936) it seems probable that the humus in the introduced soil was physiologically unsatisfactory.

Frank deduced from his experimental observations with the Cupuliferae that carbon, nitrogen, and mineral nutrient compounds obtained from the breakdown of the humus were made available to the trees by means of the fungus mantle and osmotic processes in a manner comparable to root hair absorption in non-mycotrophic plants. He concluded that the fungus mantle of the ectotrophic mycorhizas acts as the tree's absorbing system. The experiments leading to these conclusions were largely repeated with *Pinus sylvestris* with similar results. It was also shown that all the mycotrophic plants investigated would not grow well in sterilized soil, whilst non-mycotrophic plants would. The digestion of the included fungus by the cortical cells of the mycorhizas was observed, and Frank came to regard mycotrophic plants either as parasites on saprophytic fungi or as an example of beneficial symbiosis. He extended this theory to include the case of endotrophic mycorhizas such as are present in the orchids.

The findings of Frank received much criticism and a great deal of argument took place in connection with his conclusions. One of his chief opponents was Robert Hartig, who regarded mycorhiza in general as a diseased root condition caused by the attack of parasitic fungi. He was supported in this contention by Tubeuf. Both of these investigators, however, eventually changed their opinion and at length came to regard mycorhizas as a normal healthy occurrence in many plants.

At the close of the nineteenth century Johow (1898, cf. Rayner, 1927) greatly extended the knowledge of the habits of nonchlorophyllous plants and showed them, when not parasitic, to be mycotrophic. He regarded the existence of hemisaprophytes as being established and included the epiphytic orchids in this group. Johow observed that non-chlorophyllous, non-parasitic phanerogams as a whole grow in moist, shady, humus-rich situations, and that in all but one doubtful case these plants were mycotrophic. Johow based his arguments for the existence of hemisaprophytes on the fact that they use soil humus directly as a source of organic food material.

Janse (1897, cf. Kelley, 1937) conducted researches and advanced a new hypothesis for the physiological significance of the mycorhizal relationship, and concluded from indirect evidence that the fungi were nitrogen fixers and that they provided the host plant with inorganic salts and nitrogenous and other inorganic materials, whilst in return they obtained carbohydrates from the host.

MacDougal (1898, 1899, cf. Kelley, 1937) was also of the opinion that ectotrophic mycorhizas were adapted to nitrogen fixation. This idea, however, has now been abandoned by most workers.

MacDougal supported Frank in his contention that in the symbiotic relationship the fungus supplies the host with nutrients, and considered that this, together with the determined fact that all plants can use organic substances of some complexity, was the most important result of research in mycotrophy in the last decade of the nineteenth century.

At the beginning of the twentieth century, in spite of the favourable evidence already brought forward, little importance was attached to Frank's opinions respecting ectotrophic mycorhizas, although the theory of symbiotic relationship was not abandoned. Sarauw (1893, cf. Hatch, 1937) regarded the fungi as harmless and useless to trees, whilst Moller (1902, cf. Rayner, 1927) disputed Frank's view that *Pinus sylvestris* does not come to maturity on normal soils if mycorhiza formation is hindered owing to the lack of humus and the appropriate fungus.

One of the most important publications on the mycorhizal relationship at this time was that of Stahl (1900) (cf. Rayner, 1927; Kelley, 1937; Hatch, 1937). He contradicted Frank's idea as to the absorption of organic nitrogen from the soil. In his opinion mycotrophic plants were distinguished from non-mycotrophic ones by their weaker transpiration, smaller root development, and the absence of root hairs and the presence of fewer vascular vessels. In their leaves more sugar than starch was formed. The deficient water circulation, and hence the deficiency in mineral salts, is compensated for, according to Stahl, by the mycorhizas, thus explaining why there are no mycotrophic plants in soils rich in salts. Mycotrophic plants, according to him, grow in soils rich in humus and poor in mineral salts. Stahl considered that because the fungal hypae could absorb the nutrient salts of the soil with much greater ease than could the roots of the higher plants, there is a struggle in the humus between the vascular plant and the hypae. In the struggle only mycotrophic plants can survive.

Petri (1915) (cf. Rayner, 1927) considered that Stahl's conclusion in regard to the compensatory factors of sluggish transpiration and root infection by mycorhizal fungi was erroneous, and that mycorhiza formation was an aggravating circumstance, since there was a slower root development the more intense the infection. Modern work has indicated moreover that a rapidly absorbing and rapidly transpiring plant is not for this reason specially favoured in the competition for mineral salts. Stahl's experiments with plants growing in sterilized soil are open to criticism on account of his conclusion that the increased growth in sterile soils was due to the elimination of fungal competition. Russell (1921) has shown that sterilization has a manuring effect by making more nutrients available. Stahl's conclusions are, however, still held in general by most workers.

Following Stahl's paper in 1900, interest was mainly directed to endotrophic types of infection, and much interesting research during the first twenty years of the century was carried out. Little work was done in connection with forest trees, but the information gained concerning the carbohydrate nutrition of the orchid may have a direct bearing on the mycorhizal relationship of pine trees, as will be discussed later.

From the above brief outline it will be seen that all views regarding the significance of the mycotrophic habit in trees have had their supporters. Some authors, including MacDougall (1922), Koki Masui (1926), and Burges (1936), have regarded all root fungi as parasitic, whilst Frank, Stahl, Muller, and Tubeuf believed the association to be a beneficial symbiosis. There is no unity of opinion concerning the form of the nutrients supplied by the mycorhizas; carbon, nitrogen and mineral salts are all suggested, with emphasis on the latter. Rexhaussen (1920, cf. Rayner, 1927; Kelley, 1937) was of the opinion that the relation between fungus and root in ectotrophic mycorhizas was not fixed, but varied with the soil conditions. If these were unfavourable to the fungus it was likely to parasitize and injure the tree; if too favourable infection was feeble and mycorhizas badly developed. He thought that beneficial symbiosis existed, particularly when a carbohydrate supply exterior to the roots was associated with a deficiency in mineral salts. Rexhaussen's views are closely similar to modern conceptions.

It was left to Elias Melin (1925) to provide reliable evidence concerning the nature of the association between certain trees and fungi, and the publication of his results signalized a marked advance in the knowledge of ectotrophic mycorhizas. He showed that in freshly-drained moor soils in which only pseudo-mycorhizas were previously present the appearance of mycorhizal fungi must occur before successful growth could be obtained in conifers. The fungus which he constantly isolated from pseudo-mycorhizas did not form true mycorhizas in culture, but lived parasitically in the plants. He showed that mycorhizal fungi grow very slowly when separated from the tree roots, and in culture organic substances are better food sources than inorganic ones. The most favourable pH value for the development of a fungus symbiont was found by Melin to be 5·0, and he linked this fact up with the occurrence of well developed mycorhizas in acid forest soils of pH 4-5. Similar results were obtained and adapted to practical use by the writer (Young, 1938) in Queensland forest nurseries.

In one of his papers (1925) Melin described a long series of experimental cultures which were designed to investigate the nutrition of both symbionts in coniferous mycorhizas and to throw light upon their inter-relationships. He developed a simple but effective technique for growing pine seedlings in pure culture with and without infection. The stimulated growth of mycorhizal fungi when in contact with tree roots was attributed by him to the effect of phosphatide excretions by the roots. He could obtain no evidence of nitrogen fixation by the fungi concerned.

The main theme of Melin's work was that mycorhizas are of vital significance to trees and other plants growing in acid humus.

Since the publication of Melin's work (1925) interest in mycotrophy has become more general, particularly in regard to tree mycorhizas. This is probably due to the importance now attached to the artificial propagation of softwoods. Many cases of the failure of coniferous nursery seedlings to make satisfactory growth have occurred in various parts of the world, including Australia, and investigations have shown that these failures have been due to the absence of appropriate fungi in the soil, resulting in the lack of mycorhizal development (Rayner, 1938). Artificial inoculations with these fungi have resulted in the successful growth of the plants.

In recent years two important contributions were made to the knowledge of the mycotrophic phenomenon by Rayner (1934, 1936) and Hatch (1933, 1937). In 1934, Rayner as a result of her work with *Pinus pinaster, Pinus radiata,* and *Pinus laricio* expressed the opinion that different soil environments caused the development of different types of mycorhizas. This was in agreement with the previously noted opinion expressed by Rexhaussen. In her investigations carried out on Dorset Heath soils at Wareham, Rayner showed that soil factors inimical to the growth of mycorhizal fungi were capable of causing poor growth in some of the sowings. In 1936, Rayner described a number of composts developed with the object of changing the biological direction of activity in these inimical soils by causing a difference in the course of humus decomposition, resulting in the formation of healthy mycorhizas and the production of vigorous plants. The composts were not added in quantities sufficient to have any manurial value, but acted as a means of altering the biological status of the humus.

Hatch (1933) expressed the opinion that it was from the increased absorbing surface provided for the tree by the development of mycorhizas, that the tree received the benefit of the symbiotic habit. In a later work (1937) he considered that where there is a high nutrient salt concentration no mycorhizas are formed, but that mycorhizas occur when one or several of the nutrient salts were relatively scarce. Under the latter conditions the pine trees did not grow satisfactorily unless in the presence of an appropriate mycorhiza forming fungus. This agrees with Rexhaussen's opinion that mycorhizal development in rich soils was feeble. Hatch supported the mineral salt theory of Stahl and considered that the provision of nitrogenous compounds by the mycorhizas was non-essential. Rayner, however, is of the opinion that a wider significance is attributable to the phenomenon and considers with Frank and other writers, that nitrogenous and mineral compounds obtained from the breakdown of the humus, as well as mineral soil salts, are provided for the higher plant by means of the mycorhizas. The evidence obtained in the experiments described in this paper support the latter view, with the addition of carbohydrates to the substances supplied.

IV. THE CONDITION OF THE MYCORHIZAS OF PINUS IN QUEENSLAND.

In Part A of this paper it has been postulated that the fused needle condition of Pinus and certain other abnormalities discussed were due to an incorrect balance between the trees and their root associates. The work on which these conclusions are based will now be discussed. Before considering the abnormal type of mycorhizas it is first necessary to be familiar with the normal balanced association.

For the purposes of comparison the structure of mycorhizas on the roots of *Pinus tæda* and *P. caribæa* growing under favourable conditions at Beerwah were taken as a standard. The trees from which these roots were collected were growing vigorously in healthy closed stands, with an average stem height of 30 to 35 feet at the age of eight years. A litter of pine needles clothed the soil, and no abnormal appearance as regards health was to be observed. Specimens taken from other healthy pine trees of the same or different species have shown similar root characteristics when grown in the same soil type.

The mycorhizas are plentifully developed in the surface layer of the soil and also in the litter horizon. The colour of the living structures is yellow-brown, becoming darker as they age. Newly formed mycorhizas are white. The coralloid type is most frequent with few once forked short roots being observed except in the case of newly developing organs. Mycelial mantles are to be seen on the mycorhizas, and the mycelium is usually so well developed as to weft together the branches of any one organ. According to these external characters the mychorizal type falls into the ectotrophic class. Hyphal strands can be seen branching out amongst the leaf litter and other plant detritus in the litter horizon from the mycorhizas present there. The proportion of living to dead mycorhizas is high at any time of the year.

For the purpose of microscopic examination mycorhizas were preserved in a formalin-acetic acid-alcohol mixture which was suggested in correspondence by Dr. M. C. Rayner. This preservative is made up according to the following formula:—

FIXATIVE FOR TREE MYCORHIZA.

Glacial acetic acid	9 c.c.
Formalin (comm.)	51 c.c.
50 per cent. alcohol	540 c.c.

This formula has proved during several years of extensive use to be eminently suitable for the purpose. Material has been left in the mixture for months without deterioration. During the paraffin embedding process the fixative is removed in the dehydration process by the various dilutions of alcohol. In embedding it has been found convenient to place several mycorhizas in the one mould so that, on cutting with the microtome, sections in the desired plane are found in the mounts. For longitudinal sections single-forked roots were picked from mycorhizas and laid flat in the melted paraffin wax. A convenient thickness of section was found to be from twelve to fifteen microns. Thinner sections usually resulted in the partial destruction of the mantle and intracellular characters.

A number of staining techniques were used for differentiation purposes, and the most satisfactory one so far used is a cotton-blue procedure. The strain was made up as a 0·5 per cent. solution of cotton-blue in lacto-phenol. For rough preparations the sections were mounted directly in the stain. For other preparations the surplus stain was removed after five minutes by washing in lacto-phenol, and the sections were then dehydrated and mounted in Gurr's mounting medium. By this method all fungal mycelia were coloured blue in contrast to the absence of staining in the cellulose of the root itself. Another method sometimes used was to stain in carbol thionin blue and differentiate in orange G. The former method, however, was the more satisfactory for general purposes.

The sections of normal mycorhizas revealed:—

(*a*) A mantle of septate fungus mycelium about five layers thick, which invested the majority of the short roots (Plate 119);

(*b*) The coralloid structure of the individual mycorhizas the branches of which were frequently wefted together by mycelium;

(*c*) The presence between both the epidermal and the cortical cells of the mycorhizal roots of a continuous network of fungal hyphae, the Hartig network, which separate the individual cells of these tissues (Plate 119);

(*d*) The continuity of the hyphae of the Hartig network with those of the mantle;

(*e*) The absence of any vigorous hyphal material inside the cells of the cortical region (Plate 119);

(*f*) The presence of products of hyphal degradation within some of the cortical cells and the remains of empty hyphae. This had apparently resulted from the so-called "phagocytic" action which is characteristic of unsuccessful attempts at mycelial establishment within the cells.

On microscopic examination the mycorhizas proved to be of the ectendotrophic type. They are assumed to be normal, because they were abundant on healthy, vigorous trees. Similar mycorhizal material, along with a selection made from other situations, was forwarded to Dr. M. C. Rayner for examination in 1935. Dr. Rayner's report was in agreement with this viewpoint concerning the healthy state of the association.

The Characteristics of Mycorhizas on Fused Needle Sites.

It was noted quite early in the investigations at Beerwah that where the soil is bare of a vegetational cover and the actual soil surface can be seen, as described in Part A of this paper, the mycorhizal system of the pine trees (*Pinus tæda* and *Pinus caribæa*) is present only in the surface soil, and in bad cases within the top inch, with the actual mycorhizas often protuding through the soil surface. Where more litter is present the mycorhizas extend more deeply into the soil and are more abundantly developed. Under poor stands of pine in which any large amount of fused needle occurs such as those previously described, the former condition prevails, and the majority of the mycorhizas are dark in colour and of a more simply branched type than in the case of the normal coralloid condition, although occasional normal ones are present. Whenever a small accumulation of vegetable detritus gathers on the ground, such as under a log or in a depression,

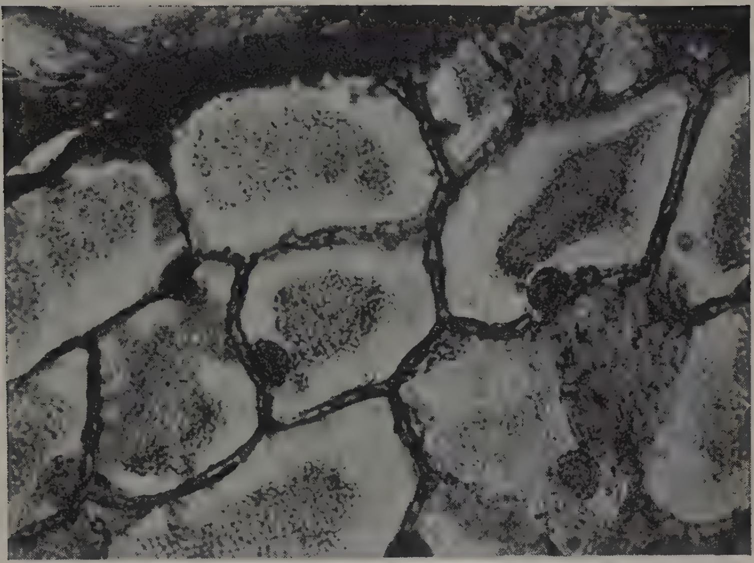


Plate 119.

LONGITUDINAL SECTION THROUGH A NORMAL ECTOTROPHIC MYCORHIZA OF *Pinus tæda.* Showing intercellular Hartig net of fungus hyphae and the absence of intracellular haustoria. The mantle is visible in the top left-hand corner. (× 900.)

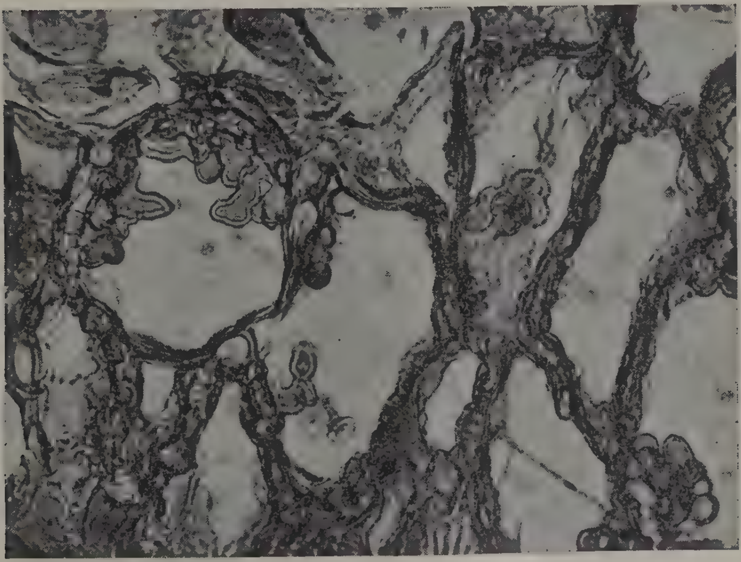


Plate 120.

LONGITUDINAL SECTION THROUGH A FUSED NEEDLE TYPE OF MYCORHIZA OF *Pinus tæda.* Showing development of intracellular haustoria from the overdeveloped intercellular Hartig net. A parasitic condition. (× 900.)

a few normal mycorhizas are found, although the trees to which they belong are in many cases badly affected with typical fused needle disease, or are otherwise poverty stricken, and have the great majority of their mycorhizas of the abnormal type.

Microtome sections of fixed and embedded material from poor stands showed the following characteristics:—

(*a*) A very thin and sometimes lacking mantle;

(*b*) A large proportion of unbranched and simply branched mycorhizas and no wefting together of the branches with a fungal network in these cases. Occasionally more normal mycorhizas are present;

(*c*) A very vigorous development of the Hartig network, the network often being two or more strands thick instead of the usual one (Plate 120);

(*d*) The continuity of the Hartig network with the mantle;

(*e*) The presence of haustorial invasions of the cortical cells from the Hartig network (Plate 120);

(*f*) The absence of hyphal degradation products in the cortical cells;

(*g*) The presence of tannic material in a considerable number of the cortical cells.

It is considered that the above symptoms represent an abnormal condition. A number of specimens of mycorhizas from fused needle trees were forwarded to Dr. M. C. Rayner in 1935 for an opinion, and the resulting report confirmed the author's views concerning their abnormality. Specimens forwarded from the roots of ten months old plants growing in the nursery at Beerwah and not showing fused needle symptoms were also thought by Dr. Rayner to exhibit an abnormal aspect. At this time 0·5 per cent. of the nursery plants (*Pinus caribæa*) were affected by fused needle disease. Dr. Rayner at that time considered from the mycorhizal evidence that the organic matter supply of the nursery was possibly below the optimum.

The abnormal type of mycorhiza was abundant on trees which did not have typical needle fusion symptoms, although they were obviously affected with some form of impoverishment, such as thin crown or short needle. The actual proportion of normal to abnormal mycorhizas appears to be definitely correlated with the vigour of the tree and the occurrence of needle fusion and other diseased symptoms. In normal healthy plantation areas the proportion of normal mycorhizas to the dark abnormal type is high, and this relationship is directly reflected by the vigour of the trees.

Many dead mycorhizas are present on the roots of trees growing in comparatively naked soils. It is thought that this low proportion of functional short roots is to a large extent due to the effects of heat and drought. The bare soil surface in summer at Beerwah frequently reaches a temperature of 140 deg. F., which must have an adverse effect on the small roots in the affected soil. When temperatures such as this prevail the soil is dry, and it is considered that the desiccation and heat kill many of the fine roots. It is possible that these conditions also result in the death of the mycorhizal fungi in the affected soil. The presence of vegetation and litter on healthy sites prevents the occurrence of excessive heating and drying.

It appears that the response to malnutrition by the aboveground parts is often variable in different individuals of the same species of *Pinus* although the mycorhizal structures show similar characteristics, indicating that the cause of the upset is fundamentally the same. In this connection it has been shown by Rayner (1934) that at Wareham, in England, "unthrifty growth of pine seedlings is directly related with defective mycorhiza formation and that the latter is associated with inimical soil conditions rather than with the absence of mycorhiza-forming fungi suitable for the trees." It is of interest to note here that since detailed descriptions of fused needle disease were published in Australia (Young, 1935; Ludbrook, 1937), the disease has been recognized in England, at Wareham, by Jones (1938). Previous to this, in correspondence in 1935, Rayner considered that a certain unthriftiness in conifers in that area was identical with our fused needle disease.

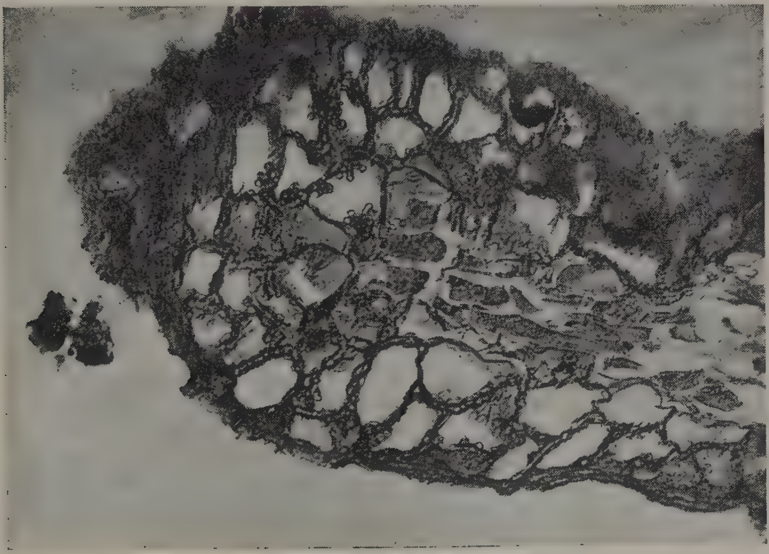


Plate 121.

Section through an Abnormal Mycorhizal Root Typical for a Fused Needle Affected Tree (*Pinus tæda*). Showing general haustorial development of the Hartig network. (× 200.)

Specimens of mycorhizas of *Pinus radiata* received from New Zealand by courtesy of the Bureau of Plant Industry at Auckland and collected from plants suffering from fused needle disease were found to be affected with a condition similar to that found in the inferior pine stands of southern New South Wales and Queensland.

The Form of Mycorhizas Under Various Soil Treatments.

The pot experiments carried out at Beerwah and the field plots involving the application of litter (Blocks K, L, M, NC, and ND) already described in Part A support the view that a supply of suitable raw organic matter is essential for normal mycorhiza development and consequent healthy pine growth. Plants grown in soil deficient in this material exhibited the typical symptoms of malnutrition as exemplified by fused needle, thin crown, and chlorosis, whilst plants in the same soil but with the addition of raw organic matter grew healthily. After two years without the addition of fresh organic matter all the plants became typically dwarfed and malformed. Even trees planted in cow dung without any other material and which at first showed exceedingly vigorous growth became diseased, although the material left in the pots at the end of the period was still organic in nature. This latter occurrence emphasises the need for the presence of the essential organic matter in a raw form.

The mycorhizas of those plants grown in soil deficient in organic matter and those grown in soil in which organic matter was present, but in a broken down condition proved to be similar when examined microscopically. These mycorhizas were of identical structure to that of specimens obtained from beneath plantation trees growing under typically badly nourished conditions as described previously. Mycorhizas obtained from pots to which fresh organic matter had been added and in which the plants were still growing vigorously were of healthy normal type.

In a case at Pechey, in South Queensland, complaints were received concerning the state of health of the plants in several of the nursery beds. On investigation, the plants showed a purplish tint of the newer foliage, and had ceased growing well after being quite satisfactory for approximately six months. Some signs of fused needle were evident. On examination of sections of the mycorhizas it was found that an unsatisfactory root-fungus balance existed and that the condition previously found at Beerwah was present in a more marked degree. On analysis, the soil was shown to contain over 3,000 p.p.m. of total phosphate. Enquiries showed that the beds had received organic manure in the form of cow dung, but it was found that this manure was old, rotted, and structureless, and apparently past the stage of optimum usefulness to the mycotrophic plants in the beds. It was accordingly advised that a supply of fresh undecomposed organic matter be applied to the affected beds. This was carried out in the form of addition of leaf litter from beneath local forest trees. The plants after this made a complete recovery. It was found from this and the pot experiment already described that when animal manures are applied to a pine nursery they should, as far as possible, although not fresh, be in a condition in which the structure is still visible.

The state of the mycorhizas produced by trees growing in the various soil treatment plots involved in the fused needle experiments at Beerwah were also investigated.

In the case of the plots receiving superphosphate the mycorhizas became normal. At the time of treatment the mycorhizas were abnormal and similar to those in typical fused needle areas. It was a very well emphasised fact that on areas very subject to fused needle the fruiting bodies of the mycorhiza-forming fungi, *Boletus granulatus* and *Rhizopogon roseolus,* were only produced on these phosphate-treated plots. Sporophores were produced on clean chipped and on otherwise untreated areas to which phosphates had been applied. A notable feature of phosphate-treated plots is the abundance of bandicoot (*Isoodon obesulus* Shaw.) burrows. This animal digs for the subterranean sporophores of *Rhizopogon roseolus,* which it eats. This production of sporophores by the fungus fits in well with Melin's hypothesis (1925) that the fungus receives from its association with the higher plant phosphorus, in the form of phosphatide, which enables it to complete its life cycle.

On partially affected sites, plots under a natural ground cover and which were used for controls showed a distribution of normal and unhealthy mycorhizas, varying with the health of the stand. Normal mycorhizas occurred in situations where there was an accumulation of litter, and abnormal in humus deficient situations. When an area affected by fused needle disease (not of the exceptionally severe form) receives normal tending and is subject to the accumulation of a natural ground cover it usually recovers with age. The presence of abnormal mycorhizas then becomes infrequent. At this stage a constantly replenished supply of litter is present supplying the necessary type of raw organic matter with its combined phosphorus.

The condition of the mycorhizas in plantation plots kept clean of vegetation since 1934 by chipping and raking was almost wholly abnormal. Very few healthy mycorhizas were to be found, save an occasional one in some small local humus accumulation. The mycorhizas were in the surface of the soil and very dark in colour. The simple (einfach) type predominated. The condition of the trees is such that all were affected by malnutrition, the majority of them being in a typically needle fused state. From this it seemed evident that the absence of a supply of vegetable detritus is correlated with the appearance of the abnormal type of mycorhizas described and with the onset of malnutrition in pine trees, as evidenced by the manifestation of fused needle disease in its various forms.

Mycorhizal development in the plots treated with forest litter was very plentiful. The roots of the trees ramified through the litter on the soil surface and bore numerous coralloid mycorhizas with wefts of hypae extending out into the litter. The mycorhizas on section proved to be normal and healthy. With the advancement of time, however, the general character of the mycorhizas altered until, two years after the application of the litter, the abnormal parasitic type had made its appearance in great numbers. The fused needle condition and general growth of the trees improved until that time, as is evident from the figures supplied in connection with these treatments earlier in this paper, but became worse after two years and is still on the down grade. In the case of plots where additions of fresh litter were made at intervals, this retrogression did not occur and the mycorhizas remained normal, and the plants continued to grow well.

The degeneration of the mycorhizal type with the ageing of the litter would seem to be bound up with the decreased usefulness of the litter as a fungal food. It is probable that some essential constituents, probably cellulose and phosphorus, are depleted during this time, and that for vigorous and normal mycorhizal development a continual replenishment of these by the addition of fresh material is essential. The possible accumulation of toxic break down products may be having an inimical effect on the root systems.

No cases of fused needle disease recorded have yet occurred which do not appear to be associated with an unsatisfactory humus supply and incorrect mycorhizal equipment. The peat soils at Wareham, in England (Jones, 1938), on which the species of *Pinus* planted have developed fused needle disease appear to be a similar case to that of a peat soil examined at Twofold Bay, Southern New South Wales, where *Pinus radiata* twenty years of age has yet failed to form trees and exhibits typical fused needle disease, together with the other aberrant symptoms usually found with the species in question. In peat soils it is considered that the same factor is operating as in the case of the old littered plots at Beerwah. That is, although there is an abundance of vegetable compost, fused needle occurs simply because this organic matter is in the wrong state to support normal growth of the mycorhizal fungus. The appearance of fused needle disease under swampy, water-logged conditions in humic bogs in Queensland would also fit in with this hypothesis. The work of Rayner (1936) has shown that addition of substances to activate the peat soils at Wareham and start biological activities in a different direction is capable of producing healthy pine growth. Another possible factor operating is the accumulation in these peat soils of harmful products of metabolism in old raw humus, so that the growth of the mycorhizal fungi, and mycorhiza formation, is endangered (Melin, 1925).

[TO BE CONTINUED.]

* * *

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

MAY.

Miles	1st
Monto	1st and 2nd
Yarraman	3rd, 4th, and 6th
Millmerran Rodeo	6th
Longreach	6th to 8th
Mundubbera	8th and 9th
Beaudesert Show	8th and 9th
Beaudesert Campdraft	10th and 11th
Nanango	9th to 11th
Blackall	13th and 14th
Roma	14th to 16th
Gayndah	15th and 16th
Mitchell	15th and 16th
Murgon	16th to 18th
Warrill View	18th
Ipswich	21st to 24th
Goomeri	23rd and 24th
Biggenden	23rd and 24th
Baralaba	23rd and 24th
Baralaba Rodeo	25th
Kalbar	25th
Gympie	30th and 31st and 1st June
Lowood	31st May and 1st June

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	23rd to 25th
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th

AUGUST.

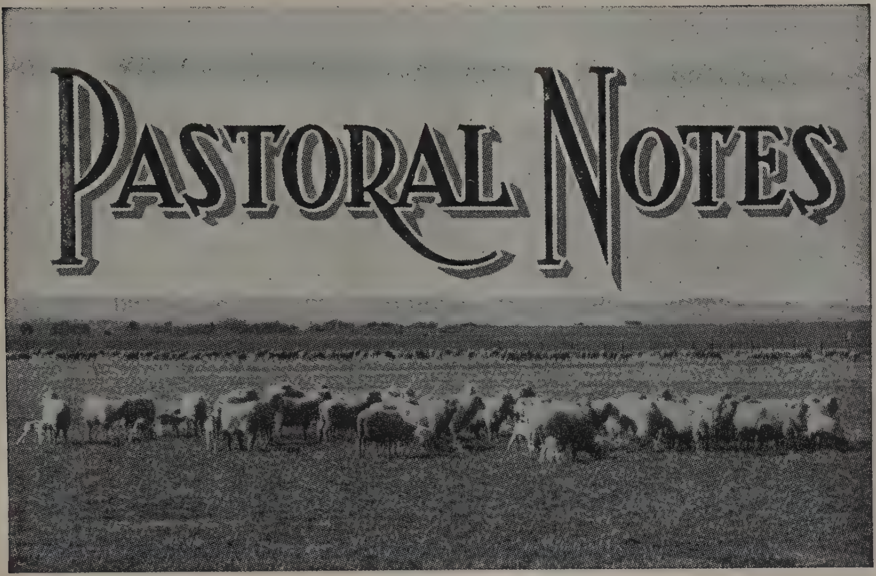
Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Atherton	6th and 7th
Caboolture	8th and 9th
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Rocklea	14th
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th



Sheep-Drenching.

REPORTS have been received from sheep owners at various times of ill-effects following the use of the nicotine sulphate and bluestone drench, which is advised for the removal of hair worms from sheep. This drench is perfectly safe providing the sheep owner knows when and how to use it. Where it is followed by ill-effects these are usually due to—

1. *Careless Mixing.*—Nicotine sulphate is a highly poisonous drug, therefore the mixing of the drench should be given every care. The nicotine sulphate is measured in fluid ounces and not in ounces weight.

2. *Careless Administration.*—The majority of ill-effects which have followed the use of this drench are due to careless administration. The dose given depends, not only upon the age, but also upon the condition of the sheep. The recommended doses are for sheep of various ages in fair to good condition. If the condition of the sheep is low, the dose should be reduced about one-fourth.

If the drenching is hurried, a portion of the fluid may enter the lungs of the animal with fatal results. It requires only a very small quantity of nicotine sulphate to kill a sheep should it reach the lungs. In hurried drenching, which is most frequently the case where automatic drenching guns are used, the tissues of the mouth and throat may become cut or bruised. The nicotine sulphate is rapidly absorbed through these wounds with frequently disastrous results.

While the nicotine sulphate and bluestone drench is highly effective against stomach worm, it should not be employed where a heavy stomach-worm infestation is present. Under such circumstances this drench becomes dangerous, as it may be rapidly absorbed into the body.

In sheep which are suffering from stomach worms, bluestone alone should be used.

It is always wise, before drenching a flock, to find out which species of worm is responsible. This can be readily determined by killing and examining one of the most affected sheep.

A LAMB-MARKING AND BLOWFLY SPECIFIC.

A lamb-marking and blowfly specific should be an antiseptic as well as a healing agent, and, besides killing the maggots present, it should give some protection to the sheep or lambs against maggots developing from a future strike, and should be easily washed from the wool during the scouring process.

A mixture recommended for use is made up as follows:—40 per cent. Shell dieselene oil or Vacuum 28-38 fuel oil; 55 per cent. fish, herring, or cod oil; 5 per cent. cresylic acid; and 0·1 per cent. sodium arsenite, or 1 lb. to 100 gallons.

For convenience in making 5 gallons of the mixture, take 22 pints fish oil, 16 pints fuel oil (not more than 875 specific gravity), 2 pints cresylic acid, and 1 oz. sodium arsenite.

To Mix.—Place the fish oil in a 5-gallon drum and add the sodium arsenite; shake well, and then add the cresylic acid and fuel oil. Should the weather be cold, heat at least some of the fish oil, and add the sodium arsenite and shake to secure a good suspension, and then add the other ingredients as above. The mixture should be well shaken before using, and shaken up occasionally to keep the sodium arsenite in suspension while in use. Apply with a clean brush or swab. In purchasing in quantities to make 100 gallons of the specific, the approximate price per gallon, including the container, has worked out at 3s.

DISINFECTION.

The object of disinfection is to destroy organisms and ultra-visible viruses which cause disease. It is a job which should certainly be done after the occurrence of one or more cases of contagious disease—such as tuberculosis, contagious abortion, swine fever, and influenza.

Periodical disinfection of stables, milking sheds, piggeries, and poultry runs is highly commendable as a measure of disease prevention.

The extent and thoroughness of the work would depend on the nature of the disease which had occurred, and would not need to be so extensive or intensive when merely carried out as a routine measure.

A common error in disinfecting premises is to first remove accumulations of excreta, discharges, dirt, and dust. Otherwise, the causal organisms and viruses contained in the accumulations are disseminated throughout the building, and may lodge in places which cannot be easily covered by the disinfecting solution afterwards.

The proper way is first to apply liberally to all parts of the premises a suitable disinfectant in solution, and to leave it in contact for twenty-four hours.

After the disinfectant has been allowed to act for that period, the walls and floors should be scraped (or scrubbed), and the scrapings soaked with kerosene and burnt.

Suitable solutions are phenol or other coal-tar preparation (1 pint to 4 gallons water), chloride of lime (1 lb. to each gallon of water), or crude carbolic acid (1½ pints to 4 gallons water), to be sprayed on all surfaces.

If shearing sheds and yards are disinfected before shearing commences, losses of stock through infection of wounds may be avoided.

"TICK WASHING" AND TICK FEVER.

Young cattle possess a natural resistance to tick fever, but this gradually grows weaker until at the age of twelve months for all practical purposes it ceases to exist. The foregoing applies to calves reared in clean areas and also (and this is the important point) to calves reared in ticky areas if such calves are sprayed so often and so regularly as to keep them entirely or almost entirely free of ticks. Under such conditions, the resistance to tick fever of calves in ticky areas at the age of twelve months will be little better than that of calves reared in clean areas.

The matter is worthy of close attention, as some farmers definitely overdo the treatment of calves for tick infestations. The belief is, of course, that the growth rate of the calves will be increased and their general wellbeing bettered, but although this is true enough, it is, notwithstanding, a dangerous course to pursue, as mortality from tick fever is likely to follow at the age of eighteen months to two years or older.

Calves should be allowed to carry a reasonable number of ticks from a few weeks old onwards. In this way their natural resistance to tick fever will be continually reinforced, so to speak, so that at the age of twelve months it will be just as strong as it was during the first few weeks of life. In normal circumstances, this resistance will, if the animal is continually exposed to moderate numbers of ticks, be retained throughout life.

TO PREVENT BRUISING IN TRUCKING YARDS.

Some bruising of stock occurs in the trucking yards, and it is quite commonly held that this is unavoidable. Suitable design of yards and races and quieter working of stock are the answers to this fallacy.

In moving cattle from yard to yard or pen to pen, there is some congestion just before, during, and just after passing gate or race. It is obvious that at such places rails should be flush with the posts and padding used where the fences make sharp angles. It is equally obvious that working must be very steady to avoid jamming and, consequently, bruising—more particularly with the outside beasts. To prevent undue crushing at the approach, it is best to have the fences funnel—or V-shaped. If the wings are long and the gate wide the working is not slowed up and the number that can pass through is regulated well back, so that a jam does not occur at the actual place of passage. After passing through, there should be no obstructions to prevent fanning out. For this reason, a straight fence forming a side of two yards is not desirable when a corner gate is used.

When working cattle through one yard to another, gates should be opposite each other—i.e., in a direct line with the direction in which the beasts are streaming. The wings to a crush should both converge. It is bad practice to have one wing in a direct line with one side of the crush. This is often the case when an existing fence is used for one wing. As cattle work better uphill, the loading-out race or crush should be slightly inclined upwards to the truck.

The Dairy Farm

Cleanliness in Cow Bail.

OBSERVATIONS at milking time on some dairy farms reveal carelessness which is dangerous from a viewpoint of infection from bacteria. Bacteria in milk and cream are well-known causes of low-grade, inferior products, and safeguards against their introduction are essential.

The milking bucket should on no account be used as a washing utensil, either for the udder and teats of the cow or the milker's hands. The act of washing the udder transfers innumerable bacteria with the dirt and loose hair to the bucket, and a simple rinsing in cold water is not sufficient to remove them all. The need for separate milking buckets and washing buckets is therefore very obvious.

A bucket and cloths for washing the udders and a wash basin for washing the hands before milking each cow are hygienic necessities in the bails. The dairyman may well ask himself the question: "Would I take my meals with hands unwashed after completing milking operations?" The answer would be an emphatic "No!" Yet the cleanliness of his hands during milking is at least as important, for milk and cream are foods which may be easily contaminated.

Clean hands are just as essential during milking as at the dining table. It is therefore remarkable that many people who are scrupulously clean in the home are lamentably careless in the cowyard and dairy.

Another very common practice is the wiping of soiled, milky hands on the clothing. These same clothes, if worn throughout the day, soon acquire a most objectionable smell and attract flies. Sugar-bag aprons—which are easily made, inexpensive, and long-wearing—are suggested for use by all milkers. The aprons should, of course, be washed frequently.

The protection of milk against flies is also a matter of consideration. Most dairymen have in use a large, shallow milk vat, and this should be provided with a lid on which an opening has been left for the milk strainer, or, if milking machines are in use, for the releaser. This lid keeps out dust and vermin, and also is a help in maintaining the temperature of the milk before separating.

Hand milkers frequently moisten the cows' teats during milking from the milk in the bucket. This practice cannot be condemned too strongly, as the hands are usually soiled, and bacteria from the udder of the cow are transferred to the bucket.

The following points are all practised by the most successful dairymen:—

Wash the udders in buckets used only for that purpose.

Wash the hands after milking each cow.

Wipe the hands on a clean cloth, not on the clothes, and wear either an apron or overalls.

Aprons and overalls are easily boiled; so keep them clean.

Don't use an uncovered vat. Under the Dairy Regulations a cover for the vat *must* be provided.

A COMMON WINTER DEFECT IN MILK AND CREAM.

Now that cooler weather is approaching, a flavour defect which is likely to be a frequent cause of trouble in milk and cream is tallowiness —a defect which, depending upon its intensity and stage of development, is usually described as metallic, oxidised, oily, mealy, cardboard, and "cappy" taint. Although tallowy and related flavours may be brought about by other influences, they are usually traced to the exposure of milk products to metallic contamination, notably copper from factory appliances and iron from dairy farm equipment.

The more common occurrence of these faults in winter depends upon the ability of minute traces of metals in solution in milk and cream to accelerate chemical changes between the oxygen normally present in these liquids and a certain constituent of butterfat, with the formation of compounds which impart the characteristic flavours. Such low concentrations as 0·2 part per million of copper and 1·5 parts per million of iron will impart an objectionable taint. In summer, when microbial development is most active in milk, the dissolved oxygen is rapidly used up by the organisms for their own growth, and so they actually help to prevent the onset of tallowiness. Their action in this single instance in retarding rather than promoting the deterioration of milk and cream is in striking contrast with their usual behaviour, as they are responsible for almost all the major faults which occur in milk products.

The most up-to-date factory processing is quite unable to renovate tallowy cream, which, therefore, is always classed as second or pastry grade. Dairy farmers should look over all metal utensils with which milk comes into contact, and any from which the tin coating is worn off, or which shows signs of rusty patches, should be retinned if their condition warrants the expense. Any piece of equipment which is too old or in a state of disrepair which does not justify the cost of retinning should be immediately dumped. The continued use of such unsatisfactory utensils during the winter months will almost certainly mean de-graded cream and substantial monetary loss.

DRY MILKING IS CLEAN MILKING.

Milking with hands which are moistened with milk at the beginning of and during milking is known as wet milking. Dry milking—which is used always by the cleanest and most efficient milkers—means commencing with clean, dry hands, which are kept as dry as possible during milking.

The method of milking with unwashed udders and teats and moistening the unwashed hands with milk is an objectionable and dirty habit and seriously contaminates the milk, as well as chapping the teats. To anyone who doubts this no further evidence is necessary than a glance at the accumulation between the fingers of a person who practises wet milking. In some countries where milkers' competitions are held at agricutural shows and elsewhere, deliberate wet milking disqualifies a competitor.

It should be remembered by the dairy farmer producing milk for city or town requirements that wet milking causes loss of keeping quality, a serious disadvantage in a warm climate.

It is often claimed that dry milking is difficult for anyone unaccustomed to it, and in attempting a more hygienic method, vaseline is used as a lubricant to make stripping easier and to help keep the teats soft and flexible. This is certainly to be preferred to careless wet milking, but if the teats are washed before starting to milk and the milker also washes and dries his hands frequently during milking—as required by the Dairy Regulations—both are generally sufficiently pliable and the use of vaseline should be unnecessary.

Injured or chapped teats should be protected during milking by placing round them a piece of cotton wool and afterwards applying a suitable ointment. The ointment hastens healing and softens the teats for the succeeding milking.

LOW PRODUCTION COST.

Many dairy farmers supplying milk have cows capable of giving more than the one or two gallons they produce, but an owner is often sceptical as to whether the extra food required will be paid for out of increased production.

A simple trial lasting a fortnight will show how to rearrange both feed and production. Arrange for those cows which can be reasonably expected to produce more to get the extra feed. It should take the form of concentrates. A simple mixture for the production of an extra gallon is 3 lb. of maizemeal and of high-quality meat meal. Gradually bring the animals under test on to the full feed—usually a week is adequate. Test over a further week.

The cost would not exceed 7d. daily per cow. The increased yield in terms of cash then determines whether the particular cows under test are worth the extra feed. If they are, then it may pay to pension off low producers and apply the cost of their food to the purchase of concentrates for the proved animals.

In practically all cases, the food for two ½-gallon cows or one 1-gallon cow costs more than the extra feed which is to produce an extra gallon from a better milker.

The saving in labour also is worth consideration.

COMFORT FOR COWS IN WINTRY WEATHER.

The dairy farmer who rugs his cattle during wintry weather usually reaps the advantage of an undiminished cream return. Many other farmers would like to follow suit, but are deterred by the cost of buying a good warm rug. There is no reason, however, why a farmer so placed should not make his own cow rugs. All that is required are the necessary number of corn sacks, a ball of twine, a packing needle, and ordinary ingenuity.

A warm rug can be made out of two corn bags, but for a big beast three bags might be necessary. Split the bags down the seams, sew them together, and place on the cow. After getting the right fit, cut off a strip of bagging so that the rug will not hang too low. This strip cut off may then be folded and sewn to the rug as a thigh strap. The front of the rug is then fitted by turning up the corners and sewing them to the sides of the rug. This strengthens the rug and obviates the necessity for cutting off the spare portion, which the cow would otherwise tread on. Neck and other fastenings may be easily fashioned to make the rug complete.

This home-made rug will keep the cow warm, and after a few days' wear will become practically waterproof. The rug can be slipped off and on quite easily, and it is advisable to remove it every day, except in bleak or rainy weather. Each cow's name may be painted on its own rug. Rugging will certainly increase winter milk production.

FLUSHING THE SEPARATOR.

The test or percentage of fat required in cream should be not less than 38 per cent. during the hot summer months and not less than 34 per cent. during the cooler months of the year. Whatever make of separator is used, during the process of separating satisfactory results can only be obtained when the cream screw is adjusted so that the driven speed of the separator conforms with the corresponding number of resolutions per minute recommended by the maker of the machine.

At the completion of separating, flushing with cold or warm water so as to remove the last of the cream from the patties is an undesirable practice. If the cream bucket is not removed during the process some of the impurities and slime adhering to the bowl may be removed and deposited in the cream. This applies particularly if warm water is used. When separated milk is used for flushing, excessive milk solids are introduced into the cream, and these will have a detrimental effect on quality, as well as lowering the fat test. Thus the proceeds of flushing should be fed to the pigs or calves on the farm. The maintenance of cream quality is too important to be impaired by laxity in this respect.

TO CHECK A BAD HABIT IN CALVES.

Skim milk-fed calves are often seen sucking each other after the buckets have been emptied. This bad habit should be stopped. Septic conditions, malformed teats, distorted udders, and early lactation in heifers may be traced to the habit of calf sucking calf. Either keep the calves away from one another by leg-roping until the taste of milk has dissipated, or feed them with meal—e.g., crushed or ground grain, pollard, bran, &c.—immediately after they have finished the milk.

The PIG FARM

Care of Weaners.

TO obtain best results from pigs, they should be kept growing steadily from the time they are born until they are marketed. As about half the pig's ration is used to maintain body heat and physical energy, fast-growing pigs will ultimately require less food for maintenance than the slow-growing ones. Hence the practice of growing weaners slowly up to store stage and then feeding heavily for a few weeks is not recommended, particularly when food is plentiful.

Weaners should not be forced to experience sudden changes in diet after their dam has been removed; such changes will check their growth, and weaners so treated usually require extra time and food to prepare them for market.

Heavy weaning weights at eight weeks are evidence of good sows and proper management. At this time, the young pigs should be practically independent of the sow, if they have been trained to feed from a trough, and so there is little or no check to their growth when weaned. Pigs which weigh 40 lb. to 50 lb. at weaning time usually reach market weights sooner and on less food than weaners weighing 20 lb. to 30 lb. Therefore, proper attention to the weaners is important in any effort to market pigs quickly and economically. One of the rules of the piggery should be *heavy, healthy weaners.*

SALT FOR PIGS.

Salt is harmful to pigs only when fed in excess. In tests to determine whether salt has any toxic effect increasing amounts up to 2·5 oz. of salt a day were fed to pigs, without any harmful result, and the animals gained normally in weight. This result was obtained under conditions in which the pigs had free access to water, for if pigs are fed increasing amounts of salt without water the result will be disastrous.

OILING PIGS.

In cool weather, pigs do not wallow in mud holes as they do in the warmer months, and so they do not have their natural protection from body lice.

The pig louse is fairly large—about $\frac{1}{8}$ inch in length—and easily seen if the pig's hair is turned back, or if sucking pigs are examined around the thighs and under the belly.

Pigs which are heavily infested with lice are unthrifty and slow-growing, become debilitated, and are more susceptible to diseases.

The control of lice should receive the attention of pig raisers, for it is uneconomic to have lice-infested stock. Treatment with oil is practicable and inexpensive. Any oil applied to the pig's skin will destroy lice which come in contact with it. An oil in common use is crude petroleum oil. An efficient method of application is by spraying a very thin mist of oil through a pump spray, so that the pigs are completely covered with a thin film of oil. The oiling should be done in the late afternoon so that the sun will not cause the oil to "burn" the pigs. The pigs should be congregated in a race or pen or at the feeding trough, so that time and oil may be saved.

Three thorough oilings given at weekly intervals should assure complete control of pig lice.

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PIG FEEDING.

With good prices for pigs, it usually pays the farmer to purchase some concentrated foods to feed in conjunction with home-grown foods, which are relatively inexpensive, but insufficient to feed all his pigs properly. It rarely pays to keep pigs in store condition.

Given good weather conditions during the winter, the milk supply may not fall to any great extent, as forage crops would be available for dairy cattle. Forage crops could also be grown for pigs. Good green forage may be used to replace one-third of the growing pigs' ration and two-thirds of the dry sow's ration; hence, when weather conditions are favourable, an effort should be made to provide a succession of forage crops for pigs, and thus save an appreciable amount of grain, meal, and milk.

Crops suitable for autumn and winter planting include rape, field peas, and oats. Rape is a very quick-growing crop under favourable conditions, and is usually ready for grazing eight to ten weeks after planting. If the pigs are removed from the crop when most of the leaves have been eaten, the crop should make fresh growth, and in this way three or more grazings may be obtained. Field peas are best grazed by pigs when the seed pods are well formed, while the plant is still green; oats should be grazed off by pigs when about 10 inches high.

Wherever practicable, grazing is more satisfactory than cutting the crop and feeding it to pigs in their pens. If the regular pig paddocks can be cultivated, cropped, and fed off, the soil fertility will benefit, much labour and food will be saved, and the sanitation of the piggery will be improved.

Registered Hatcheries

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale	Australorps
E. J. Blake, Rosewood	Sunnyville	White Leghorns, Australorps, White Wyandottes, and Rhode Island Reds
A. F. Buchler, Milman	Pincrow	White Leghorns
R. H. and W. J. Bowles, Glenmore road, North Rockhampton	Glen	White Leghorns and Australorps
J. Cameron, Oxley Central	Cameron's	White Leghorns and Australorps
M. H. Campbell, Albany Creek, Aspley	Mahaca	White Leghorns and Australorps
J. E. Caspaney, Kalamia Estate, Ayr	Evlington	White Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme	Australorps, White Leghorns, and Rhode Island Reds
Dixon Bros., Wondecla	Dixon Bros.	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
Elks and Sudlow, Beerwah	Woodlands	White Leghorns and Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's	Australorps and White Leghorns
Gisler Bros., Wynnum	Gisler Bros.	White Leghorns
G. Grice, Loch Lomond, via Warwick	Kiama	White Leghorns
J. W. Grice, Loch Lomond, via Warwick	Quarrington	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. and C. E. Gustafson, Tannymorel	Bellevue	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby	White Leghorns and Anconas
H. Hufschmid, Ellison road, Geebung	Meadowbank	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds

Name and Address.	Name of Hatchery.	Breeds Kept.
J. McCulloch, White's road, Manly	Hindes Stud Poultry Farm	White Leghorns, Brown Leghorns, and Australorps
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
A. Malvine, junr., The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore ..	Stonehenge ..	Australorps and White Leghorns
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
J. A. Miller, Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, White Leghorns, and Brown Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric	White Leghorns
J. W. Moule, Kureen ..	Kureen ..	Australorps and White Leghorns
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Light Sussex, and Silver Campines
S. V. Norup, Beaudesert rd., Cooper's Plains	Norups ..	White Leghorns and Australorps
H. W. and C. E. E. Olsen, Marmor	Squaredeal ..	White Leghorns, Black Leghorns, Australorps, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Langshans, Rhode Island Reds, Light Sussex, White Wyandottes, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Douglas street, Oxley Central ..	Pennefathers ..	White Leghorns and Australorps
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Brown Leghorns, Australorps, Langshans, White Wyandottes, Rhode Island Reds
G. R. Rawson, Mains road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View ..	White Leghorns and Australorps
H. K. Roach, Wyandra ..	Lum Burra ..	Australorps and White Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns and Australorps
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, Waterworks road, Ashgrove	Smith's ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
A. G. Teitzel, West street, Aitkenvale, Townsville	Crescent ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkins' ..	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Atherton ..	Weaver's ..	Australorps, White Leghorns, Buff Leghorns, Wyandottes, Anconas, Indian Game, Rhode Island Reds, Barred Rocks, Buff and Black Orpingtons
H. M. Witty, Kuraby ..	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	White Leghorns, Brown Leghorns, and Australorps
R. H. Young, Box 18, Babinda	Reg. Young's ..	White Leghorns, Australorps, and Brown Leghorns

Following is a list of new applications received up to the 20th March, 1940:—

Name and Address.	Name of Hatchery.	Breeds Kept.
B. Cross, Apple Tree Creek, Childers	Spring Hill ..	White Leghorns, Australorps, and Langshans
O. M. Dart, Upper Brookfield ..	Woodville ..	Australorps, Rhode Island Reds, White Leghorns and Langshans
C. Mengel, New Lindum road, Wynnum West	Mengels ..	Australorps
V. White, Cleveland	Pinklands ..	White Leghorns

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MARKING EARLY LAYING PULLETS.

The marking of early laying pullets provides a practical method of selection where the trap nest is not used.

Records obtained by trap nesting in various parts of the world show that—

(1) Early laying pullets are, as a rule, the highest producers;
(2) Birds that lay late into the autumn and are late in moulting are also high producers.

As the early layers and late moulters are high producers, a marking system will assist in distinguishing between profitable and unprofitable fowls.

In one convenient system of marking, a coloured leg band is placed on the left shank of all pullets that start to lay before six months of age. A band of another colour is attached to the left shank of pullets starting to lay when six and seven months of age, and a third coloured band is used for fowls which commence to lay in the eighth month. Pullets that do not lay until after the eighth month should be eliminated from the flock, or kept in a pen by themselves, and forced for egg production.

Pullets which are early layers show the following characteristics:—

(1) A large red comb;
(2) An active disposition and a ravenous appetite;
(3) Roominess between the keel and pelvic bones;
(4) An occasional disappearance of the yellow coloration round the vent in some yellow shanked varieties.

In small flocks, individuals showing the above characteristics may be caught in the nest and then marked.

During the following season, all fowls that were marked as late maturing the previous autumn and moult in December, January, and

February can be culled. All the early laying birds and those that moult after 1st March may be kept for layers or placed in a special breeding pen and mated to a male known to have come from a high laying hen that has been trap nested. In this way the egg production of the offspring may be raised.

The method outlined is simple and, if properly employed, will raise the level of production in a flock.

FEEDING FOWLS.

Poultry-raisers as a whole have a very fair idea of the principles and practice of feeding, and take into consideration factors which make for efficient and economic production.

The present-day values of cereals may induce some to depart from old and accepted practices in order to reduce costs. There are three points, however, that must not be lost sight of, if the best results are to be obtained, and the general health of the stock maintained—viz., the vitamin content of the ration, the protein content, and the quantity supplied.

Vitamins.—Vitamin A is of outstanding importance at the present juncture, for a shortage in the ration may cause outbreaks of nutritional roup as well as lowered egg production. The feeding of yellow maize and green feed ensures a sufficient supply of this vitamin.

On most poultry farms during the winter months green feed is not plentiful; consequently under normal circumstances the loss due to a shortage of maize cannot be overcome. It is therefore of paramount importance that the poultry-raiser should make a special effort to supply the birds with good succulent green feed. Green feed is the cheapest form in which the birds' requirement of this vitamin can be supplied. In cases where home-grown feed cannot be obtained, poultry-raisers should use at least 10 per cent. of good green lucerne chaff or meal in the mash fed to their birds.

Protein.—To obtain the maximum economic production, laying birds should have in their ration (i.e., grain and mash) a total of approximately 15 per cent. of crude protein. Maize has about 10 per cent. and wheat about 13 per cent. of protein. Where maize has been used extensively and is replaced with wheat, it may be desirable to reduce slightly the protein content of the ration. This is most easily brought about by a slight reduction in the meat meal fed.

Generally speaking, however, the protein-rich meat meal is not overfed, and its greater use is advisable in certain circumstances. This is particularly so in the case of the poultry-raiser who feeds extensive quantities of skim milk to his birds. With the approach of winter the milk supply will probably diminish. In such cases the loss of protein of animal origin in the form of milk should be supplemented with meat meal.

Quantity.—Providing the right kind of food is being used, economic production is only possible by feeding the birds all they will consume. Do not be afraid of making your birds unduly fat. The good producer will convert the food supplied in excess of body requirements itno eggs. Birds which cannot do this should be culled and sold for table purposes.

Agricultural Notes

Winter Pastures.

MANY farmers will soon be preparing land for sowing winter pastures to provide grazing during winter and spring. The sowing of winter pastures should be done during late March or in April. Later sowings will be successful only if exceptionally good seasonal conditions are experienced subsequent to sowing. Annual winter pastures, which are being sown for the sole purpose of providing feed during the present year, must go in early if a long grazing season is to be obtained.

If through dry weather or some other circumstances the preparation of land intended for winter pastures has not been done thoroughly, and a fine seed-bed is not available, the sowing of permanent winter pastures is not recommended. Instead, an annual pasture should be laid down, and after the land has been ploughed in the summer the area should be well worked for autumn sowing with a permanent pasture mixture in 1941.

Winter pastures should be sown only on land of at least fairly good fertility. If success is to be achieved with valuable grasses—such as *Phalaris tuberosa,* perennial ryegrass, Italian ryegrass, and prairie grass—it is essential that the soil should be of good quality. Land not quite up to first-class standard may support Wimmera ryegrass and cocksfoot pastures, but infertile and roughly prepared land cannot be expected to maintain a good winter pasture. Cultivation areas which have been ‘‘cropped out’’ should not be put straight down to winter pasture, as is often done, but should have their lost fertility restored to some extent by green manuring.

The winter-growing pasture plants available for use include perennial species—such as *Phalaris tuberosa,* perennial ryegrass, cocksfoot, red clover, white clover, and lucerne, and annual species, including Italian ryegrass, Wimmera ryegrass, prairie ryegrass, and Berseem clover. Not all of these plants are, of course, suited to all districts, but recommendations regarding suitable mixtures for most localities in the southern dairying and agricultural districts are available on application to the Department of Agriculture and Stock.

WINDBREAKS AND SHELTER TREES.

For the comfort of stock in cold weather windbreaks are a necessity, especially on open plain or high tableland country. In timbered country, provision should be made for windbreaks when the land is being cleared, by leaving suitable stands of the original forest covering. Otherwise, the expense of establishing shelter belts will have to be incurred later on. Meanwhile, stock will have to suffer all the discomfort caused by winter's frigid westerlies, which blow usually for days on end.

In country which has already been cleared the planting of suitable trees on the prevailing windward boundaries of farms on tablelands, plains, and undulating country is, therefore, worth serious consideration. If edible trees are planted they might be used in times of drought. A farmer would naturally hesitate before destroying shelter trees for feeding purposes, but, if the necessity arises, edible tres may be lopped without destroying them.

The undermentioned trees are mainly suitable for planting on the Darling Downs. Edible types are the kurrajong, bottle tree, Portuguese elm, honey locust, and carob bean. Less palatable trees are the cypress (*Cupressus torulosa*), *Pinus radiata*—commonly known as *Pinus insignis*—white cedar, and *Bauhinia hookeri*. The well-known and admirable western tree, the wilga, should be added to this list if it is available in the local forests. Although there is a considerable amount of variation in the palatability of individual trees, the wilga is both a useful and extremely ornamental species.

In most cases the trees mentioned can be purchased from nurserymen. In the event of expense proving an obstacle to adequate planting, the trees can be raised from seed in an improvised nursery on the farm. The seeds could be germinated in shallow boxes or tins about twelve months before the young trees are required for planting. In frost-free areas June, July, and August are suitable months for planting out the young trees in their permanent locations. Some protection must, however, be given to the plants in frost-susceptible districts if midwinter planting is attempted.

Protecting the young trees from stock is most important. If the trees are planted near a boundary fence, it might be found most convenient to erect a second inner fence to keep stock away from the trees until they are high enough to be out of reach. Smaller farm stock, such as sheep, can be let into the enclosure once the trees have attained sufficient height for their foliage to be above the reach of the animals.

LUXURY CROPS ELIMINATED.

In Britain, the growing of all luxury crops has been discontinued and the production of foodstuffs substituted. Derelict orchards are being grubbed and cleared and made available for potato growing. Strawberry growing is not considered essential, and the growing of asparagus, rhubarb, as well as flowers is being discouraged in order to make room for essential vegetables.

War-time necessity also has led to a curtailment of racing, and paddocks around the big racing centres like Epsom and Newmarket are full of valuable thoroughbred horses turned out to grass.

Horticultural Notes

Bean Fly Control.

DURING recent seasons bean growers in the coastal areas, by following a tentative spraying schedule, have been fairly successful in controlling bean fly in the late summer and autumn crops. Results from recently completed departmental experiments enable definite recommendations to be made for the coming season.

The recommended spraying formulæ are:—

	(1)	(2)
Nicotine sulphate	1 fl. oz.	¼ pint
White oil	8 fl. oz.	2 pints
Water	5 gallons	25 gallons

The first application of the spray should be made three days after the first beans appear above ground and subsequent applications at four-day intervals. In the event of a particularly uneven strike, which occurs at times during a dry spell, the interval between the first and second sprays may be reduced to three days.

Four to six sprays are usually required for mid- and late-summer crops planted in February and March, and two to four for autumn and early winter crops planted in April and May. After May, spraying is rarely required. As the severity of fly attack varies considerably from year to year, growers should determine the exact number of sprays to be applied to any planting from observations of actual prevalence of flies in the crop, the extent of damage in the district, and the growing conditions of the plants.

Attention should be given to the following points:—

(*a*) Keep the plants growing well by correct cultural measures. Hill them up thoroughly to encourage the growth of secondary roots from the stem. Vigorous, rapid growth helps a great deal in the fight against this pest.

(*b*) Mix the spray in the correct proportions. Graduated measuring vessels, such as medicine glasses for small quantities or pint measures for larger volumes, are cheap and readily obtainable. Guesswork may result in waste of expensive spray materials, spray injury to plants, or inefficient fly control.

(*c*) Prepare fresh spray for each day's application. The mixture deteriorates rapidly if held in open containers.

(*d*) Spray thoroughly, though it is necessary to wet only one surface of the leaves. Use a double nozzle on the ordinary knapsack sprayer.

(*e*) If rain falls before the spray has properly dried on the leaves, apply another spray as soon as the weather clears.

THE QUALITY OF QUEENSLAND NUTS.

Subjoined is an extract from the December (1939) *issue of "The Peanut Journal and Nut World," the official organ of the Virgini-Carolina Peanut Association, Suffolk, Virginia, U.S.A., which is of especial interest to Queensland nutgrowerss—*

NUTS FROM HAWAII NEW APPETIZER.

Gourmets and housewives have discovered that Hawaiian macadamia nuts give a tantalizing and tasty flavour to their meals when used as appetizers, relishes, cocktail crunches, or blended with almost any dish to impart an exotic deliciousness. The delectable taste of this caviar of the nut industry is matched by its nutritious elements, since it contains up to 70 per cent. of health-giving oil and an abundance of protein.

The macadamia nut is a tempting round kernel about the size of a hickory nut. In its natural ripe state, you would have a great problem in eating it. After clawing away a fibrous husk about a quarter of an inch thick, you would find the kernel still enclosed in a hard shell strong enough to crack a nut cracker. If hammered away, and the kernel taken out intact, your work is still only half done, for the kernel contains more than one-fifth moisture which must be dehydrated before roasting, especially if you don't want the macadamia to taste like just any other nut.

It wasn't until four years ago that the islands began building up a macadamia nut industry to rival the pineapple industry. There has always been an undersupply of nuts in the United States and there has never been an oversupply in Hawaii. However, the 182 acres of macadamias grown in Hawaii in 1932 has increased to nearly 1,000 acres to-day. Of the 81,000,000 lb. of nuts which the United States imports a year, macadamia nuts are considered the aristocrat of the nut family, its fame arising from the delicacy of their flavour.

Now macadamias can be obtained, it is said, in four sized vacuum packed jars to add that "Here's How" tang to any meal, whether it be a formal dinner or a midnight snack. They are especially good when included in warm weather menus since they give an energizing lift to salads and desserts.

The Fruit Market.

J. H. GREGORY, Instructor in Fruit Packing.

MARCH is usually a wet month with depressing marketing conditions for fruit and vegetables. Last month these conditions were, however, offset by an exceptionally dry period in other States of the Commonwealth.

Apple values were high because of a shortage of new season fruit. Pineapples were often severely ''burnt'' by both sun and wind, which reduced factory supplies and the volume of quality lines for the fresh fruit trade. Water blister was reported as affecting the quality of some southern consignments. Bananas were in demand at high price levels. If growers refrain from sending green fruit during the approaching colder months, prices should remain firm. First lines of new season custard apples have met with a ready demand. As with bananas, growers also are cautioned against consigning green custard apples and so spoiling the market. New season citrus fruit is now coming forward to a very favourable market; in fact, prices have been higher than for many seasons past—that is, at corresponding marketing periods. Vegetables, generally, have been in short supply with values strong.

The following were the ruling market prices during the last week of March:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Small, 11s. to 15s.; Sixes, 14s. to 18s.; Sevens, 14s. to 19s.; Eights and Nines, 17s. to 20s.

Sydney.—Cavendish: Sixes, 14s. to 18s.; Sevens, 18s. to 21s.; Eights and Nines, 21s. to 24s.

Melbourne.—Cavendish: Sixes, 16s. to 18s.; Sevens, 17s. to 20s.; Eights and Nines, 20s. to 22s.

Adelaide.—Cavendish: 26s. to 28s. per case.

Bunches 1½d. to 10d. per dozen.

Lady's Fingers, 4d. to 9d. per dozen.

Sugars, 1½d. to 4d. per dozen.

Pineapples.

Brisbane.—Smoothleaf, 6d. to 3s. 6d. per dozen, 2s. 6d. to 7s. per case; Ripley, 2s. to 4s. per dozen, 5s. to 7s. per case.

Sydney.—Smoothleaf, 7s. to 13s. per case.

Melbourne.—Smoothleaf, 6s. to 10s. per case, many lines showing water blister.

Adelaide.—Smoothleaf, 16s. to 18s. per case.

Papaws.

Brisbane.—Local, 4s. to 6s. bushel case; Yarwun, 10s. to 12s. bushel case. Growers are advised to carefully select fruit which will not ripen quickly.

Sydney.—11s. to 15s. tropical case.

Custard Apples.

Brisbane.—5s. to 7s. per half bushel. Care in sending only matured fruit to market should be taken at this stage of the season to avoid causing decreased consumption which would lower prices.

Monstera Deliciosa.

3s. to 4s. per dozen.

Avocados.

Brisbane.—8s. to 10s. per half bushel.

OTHER TROPICAL FRUITS.

Rosellas.

3s. to 3s. 6d. per sugar bag.

CITRUS FRUITS.

Oranges.

Brisbane.—Navel Oranges: Locals, 8s. to 13s.; Gayndah, 14s. to 16s.; Commons, 8s. to 10s.; Second Crop Valencias, 5s. to 7s.

Grapefruit.

Brisbane.—Gayndah, 8s. to 10s.; Palestine Grape Fruit, 35s. per case, 4s. 6d. per dozen.

Sydney.—Queensland, 10s. to 14s. Immature hard of sale.

Melbourne.—Queensland Grape Fruit arriving too green and immature, making sales hard to achieve.

Lemons.

Brisbane.—Locals, 8s. to 12s.; Gayndah, 10s. to 17s.

Sydney.—Queensland, 15s. to 24s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, 8s. to 11s.; Granny Smith, 8s. to 10s.; Delicious, 9s. to 12s.; Others, 8s. to 10s.

Pears.

Brisbane.—Howell, 10s. to 13s. B de Cap, 10s. to 12s.; B. Bosc, 10s. to 12s.

Plums.

Brisbane.—N.S.W., 9s. to 10s.

Quinces.

Brisbane.—5s. to 7s. per bushel.

OTHER FRUITS.

Grapes.

Brisbane.—Waltham Cross, 8s. to 10s.; Muscatels, 10s. to 12s.

Tomatoes.

Brisbane.—Coloured, 3s. to 4s.; Green, 2s. 6d. to 3s.; Ripe, 3s. to 3s. 6d.

Sydney.—Stanthorpe, 2s. to 6s.

Passion Fruit.

Brisbane.—First Grade, 14s. to 17s.; Seconds, 8s. to 10s.

Figs.

2s. 6d. to 3s. 6d. per tray.
8d. to 9d. per box.

MISCELLANEOUS VEGETABLES.

Rockmelons.—4s. 6d. to 7s. bushel.

Cucumbers.—4s. to 5s. bushel.

Pumpkins.—4s. to 6s. bag.

Marrows.—1s. to 3s. dozen.

Lettuce.—1s. to 3s. dozen.

Cabbages.—6d. to 5s. dozen; Stanthorpe, 4s. to 9s. dozen.

Beans.—Stanthorpe, 5s. to 7s. bag.

Peas.—10s. to 12s. bag; New South Wales, 16s. to 24s. ½-cwt.

Beetroot.—6d. to 1s. 6d. bundle.

Chokos.—6d. to 1s. 6d. dozen.

Parsnips.—6d. to 1s. bundle.

Carrots.—4d. to 6d. bundle.

South Australian Celery.—14s. to 21s. crate.

Plate 122.

BENYENDA NURSERY, NEAR GAYNDAH.—In this nursery there are 60,000 citrus trees.

In Memoriam.

IWAN WASSIL HELMSING.

THE death on 23rd March of Mr. I. W. Helmsing, Illustrator, Division of Plant Industry (Research), Department of Agriculture and Stock, is recorded with deep regret. Born in England fifty-five years ago, he had a most varied and interesting life. Throughout his whole career, however, he maintained a definite interest and ability in art work and microscopy, and these interests culminated in the excellent output of scientific illustration work in the Department during the past fifteen years.

Plate 123.

As an adventurous young man he forsook clerical work, first in England and later in Germany, to explore possibilities in Patagonia, South America. After some years in the pastoral industry there, he went to New Zealand, where for a time he engaged in fruit-growing. His biological interests later gained for him an appointment in New Zealand as an instructor in fruit culture. The desire for personal independence led him to Australia and for a period he was a successful banana-grower in the Tweed River district of New South Wales—a venture that was terminated by a disastrous outbreak of bunchy top disease of bananas.

During all those years he had carried with him a microscope which he possessed as a youth, and had also developed a remarkable talent for water colour work, mainly of botanical and plant pathological studies.

By his work in the Department he soon won recognition as a scientific illustrator of high standing. His work ranged through many classes of subject-matter—such as entomological, plant pathological, botanical, and veterinary specimens—and his output had for years added to the value and attractiveness of Departmental publications by making structures and forms intelligible to readers, which verbal descriptions would never adequately convey. Published illustrations included pen and ink, wash and colour, the pen and ink drawings being of a particularly fine, painstaking, and characteristic technique that is outstanding. Much of his work, in the form of insect life history studies in water colour, line the walls of the Departmental museum and remain as a fitting and lasting monument to his memory.

In addition, Mr. Helmsing studied taxidermy while in the Department with a view to adding to the collection of preserved insectivorous birds in the museum. In recent years he took up photography as a hobby and made official use of this interest along the lines of photomicrography, producing some excellent photomicrographic illustrations where the strict authenticity of a photograph of minute structures was desirable. This photographic interest was linked with a love for the open air, his holidays being spent wandering amidst mountain scenery, mainly of the National Parks, recording striking views and studying native plant and bird life.

The death of the late Mr. Helmsing has left a distinct gap in the organisation of the Department of Agriculture and Stock, regrettable not only officially but also to his friends and colleagues, who recognised and admired his many sterling qualities. Sincere sympathy is felt for those whom he has left bereaved.

BRICE HENRY.

BY the untimely death of Mr. Brice Henry on 21st February last, North Queensland lost one of its most esteemed pioneers, and the State a citizen who in the course of a notable career had given great service to his country.

Plate 124.

Brice Henry was probably best known to *Journal* readers for his enterprise in starting a scheme for fattening cattle on tropical coastal lands on his Tully property, to which reference has been made frequently in these pages and which, it is believed, will have a far-reaching influence on the development of the beef-raising industry in the Far North. In furtherance of this scheme, he made considerable areas of land available for field trials of introduced grasses. His remarkable success with this project, already beyond the experimental stage, has been recorded in official publications of both State and Commonwealth.

Brice Henry will, however, be remembered for many other achievements. His was an essentially national outlook and with his great natural ability he became a driving force behind every progressive movement in the North. Practical, energetic, courageous, tenacious and far-sighted, he gave of his best to his generation. Quick to appreciate the possibilities of a richly endowed and yet unpeopled province, he made of land settlement and expansion a hobby. The moving spirit in enterprises which later brought abundant prosperity to his district, he had the happiness of seeing many a daring venture of his own initiation develop from phantasy to accomplished and enduring fact.

Born at Mittagong, New South Wales, in 1877, Brice Henry came while still a child with his parents to North Queensland, where they were among the pioneer settlers. In such a character-building environment he grew up to be an expert bushman with all the qualities of an intrepid explorer. North Queensland, which he knew throughout its development from untrodden jungle and trackless forest to the land of rich fulfilment it is to-day, was to him as an open book. The Tully sugar mill, to which he became one of the largest suppliers of cane, was, to a big extent, the result of his foresight, bold initiative, and business acumen. In every respect he was a big man who contributed generously, cheerfully, and ably to the welfare of the whole community. In local government, as councillor and chairman of the Cardwell Shire Council for many years, he did great work, and in every other district activity and institution Brice Henry was a leader of strength, wisdom, and kindly public spirit. Among other public offices held by him were patron of the Tully District Show Society, president of the Tully Chamber of Commerce, and member of the Tully Mill Suppliers' Executive, Tully Hospital Board and Ambulance Committee. In addition, he was a generous supporter of patriotic bodies, and for the Diggers of the A.I.F. and ex-service men generally he had a special regard.

To his bereaved family deep sympathy is extended.

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PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, the Ayrshire Cattle Society, and the Guernsey Cattle Society, production charts for which were compiled during the month of February, 1940 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	MATURE COW (STANDARD, 350 LB.)			
Nellie 4th of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	20,789·65	760·431	Reward of Fairfield
Blacklands Princess 6th	P. Doherty, Box 31, Gympie	10,275·8	411·605	Premier of Hillview
	SENIOR, 4 YEARS (STANDARD, 330 LB.)			
Kyabram Marie 3rd	A. H. E. Black, Kyabram, Kumbia	9,126·9	469·206	Springlands Brigadier
Rosehill Dahlia 3rd	W. Flesser, Boyland	9,488·5	346·981	Dnalwon Count
Palmetto Janie	R. Tweed, Kandanga	7,834·1	344·384	Glengallan Major
	JUNIOR, 4 YEARS (STANDARD, 310 LB.)			
Navillus Violet 5th	C. O'Sullivan, Navillus, Ascot, Greenmount	10,312·5	413·108	Parkview Mars
	SENIOR, 3 YEARS (STANDARD, 290 LB.)			
Barwin Royal 3rd	G. A. Meyers, Imbil	7,346·35	327·001	Blacklands Jewel
	JUNIOR, 3 YEARS (STANDARD, 270 LB.)			
Alva Glen Plum	G. H. Knowles, Alva Glen, Nanango	10,018·4	406·508	Darcy of Iroquois
Highfields Rosemary 2nd	J. A. Heading, Highfields, Murgon	8,489·65	326·952	Greyleigh Legend
	SENIOR, 2 YEARS (STANDARD, 250 LB.)			
Kalinga Roseleaf 4th	J. A. Heading, Highfields, Murgon	8,771·25	339·242	Headlands Hero
Barwin Sally 2nd	G. A. Meyers, Imbil	7,590·4	329·743	Blacklands Jewel
	JUNIOR, 2 YEARS (STANDARD, 230 LB.)			
Tevor Hill Snowflake	Geo. Gwynne, Umbiram	7,413·71	329·057	Corunna Supreme
Trevor Hill Maple	Geo. Gwynne, Umbiram	7,213·11	296·932	Corunna Supreme
Faversham Minnie (214 days)	N. Bidstrup, Warra	7,623·01	295·341	Faversham Rex
Ventnor Mab	C. W. Black, Kumbia	6,450·97	291·042	Kyabram Twinny Boy
Kyabram Marie 4th (258 days)	A. H. E Black, Kyabram, Kumbia	5,553·98	264·157	Ledger of Greyleigh
Trevor Hill Una	Sullivan Bros., Valera, Pittsworth	6,918·77	261·918	Corunna Supreme
Trevor Hill Star 2nd	Sullivan Bros., Valera, Pittsworth	5,683·29	232·276	Corunna Supreme

	JERSEY.			
	MATURE COW (STANDARD, 350 LB.).			
Woodside Xenia	S. H. Caldwell, Walker's Creek, Bell	8,416·32	481·138	Rochette's Volunteer
	SENIOR, 4 YEARS (STANDARD, 330 LB.).			
Oxford Remus Amy	State Farm H.M. Palen Creek	5,505·22	330·089	Overlook Nancy's Remus
	JUNIOR, 4 YEARS (STANDARD, 310 LB.).			
Hawthorn Brae Lady Colleen	P. Kerlin, Glenrandle, Killarney	7,067·5	373·039	Hawthorn Brae Navigator
Hurette's Hope of Inverlaw	R. J. Crawford, Inverlaw	5,778·37	321·468	Carnation Gentle Prince
	SENIOR, 3 YEARS (STANDARD, 290 LB.).			
Oxford Dahlia 5th	S. H. Caldwell, Walker's Creek, Bell	8,189·58	433·257	Oxford Belle's Ambassador
Glenview Sultane's Jubilee	F. P. Fowler and Son, Glenview, Coalstoun Lakes	8,951·75	419·035	Trinity Governor's Hope
Oxford Ambassador's Dolly	S. H. Caldwell, Walker's Creek, Bell	5,581·17	326·67	Oxford Belle's Ambassador
Trecarne Rosella 8th	T. A. Petherick, Trecarne, Lockyer	5,909·75	320·082	Trinity Some Officer
Glenview Trinket	F. P. Fowler and Son, Glenview, Coalstoun Lakes	6,454·0	291·998	Trinity Governor's Hope
	JUNIOR, 3 YEARS (STANDARD, 270 LB.).			
College Starbright 6th	Queensland Agricultural High School and College, Lawes	5,185·52	284·833	Belgonia Peggy 9th Duke
	SENIOR, 2 YEARS (STANDARD, 250 LB.).			
Palen Fleur	H.M. State Farm, Palen Creek	5,650·19	299·583	Oxford Golden Dreamer
Lermont Rosaleen	J. Schull, Lermont, Oakey	5,275·65	282 607	Woodside Golden Volunteer
Bellgarth Bonfairnette	P. Kerlin, Glenrandle, Killarney	5,158·2	271·455	Trecarne Renown 2nd
Bellgarth Goldenette	P. Kerlin, Glenrandle, Killarney	4,695·3	270·161	Bellgarth Golden King
Glenview Skylark	F. P. Fowler and Son, Glenview, Coalstoun Lakes	4,754·6	257·632	Trinity Governor's Hope
	JUNIOR, 2 YEARS (STANDARD 230 LB.).			
Tecoma Birdie	W. J. Semgreen, Kingaroy	7,114·6	380·254	Bruce of Inverlaw
Landside Dreamer's Dainty	S. H. Caldwell, Walker's Creek, Bell	5,936·62	322·707	Golden Dreamer
Lermont Treasure	J. Schull, Lermont, Oakey	5,640·15	276·988	Woodside Golden Volunteer
Brooklands Sultan's Ladylove	T. W. McMicken, Beauaraba, Southbrook	5,063·18	271·726	Brooklands Royal Sultan
Broadview Petal	W. S. Kirby, Broadview, Byrnestown	5,167·6	265·923	Glenview Mason
	AYRSHIRE.			
	SENIOR, 3 YEARS (STANDARD, 290 LB.).			
Myola Opal 2nd (245 days)	R. M. Anderson, Southbrook	9,916·84	375·994	Benbecula Bonnie Willie
	JUNIOR, 3 YEARS (STANDARD, 270 LB.).			
Myola Poppy	R. M. Anderson, Southbrook	9,403·1	356·917	Benbecula Bonnie Willie
	GUERNSEY.			
	SENIOR, 2 YEARS (STANDARD, 250 LB.).			
Laureldale Poppy	W. A. Cooke, Laureldale, Witta	6,637·85	254·958	Laureldale Peer
	JUNIOR, 2 YEARS (STANDARD, 230 LB.).			
Laureldale Veronica	W. A. Cooke, Laureldale, Witta	6,126·45	290·649	Laureldale President

General Notes

Staff Changes and Appointments.

Mr. R. P. M. Short, Under Secretary of the Department of Agriculture and Stock, has been appointed Government nominee on the Veterinary Surgeons' Board of Queensland in the room of the late Lieut.-Colonel A. H. Cory, V.D., M.R.C.V.S.

The resignation of Mr. E. S. Smith as Millowners' Representative on the Central Sugar Cane Prices Board has been accepted as from 31st January, 1940, as tendered.

Mr. J. W. Carseldine (Miriam Vale) and Mr. F. A. E. Fisher (Southport) have been appointed Honorary Fauna Protectors.

Mr. R. A. Chapman, of Bishop Island, has been appointed an Honorary Protector under the Fauna Protection Act and an Honorary Ranger under the Native Plants Protection Act.

Mr. W. A. G. Haylett, inspector under the Stock, Slaughtering, and Dairy Produce Acts, Department of Agriculture and Stock, will be transferred to Biloela. Mr. C. R. Tummon, inspector, will be attached to the Willowburn Bacon Factory, Toowoomba.

Mr. W. G. Hancock, inspector under the Diseases in Plants Acts and agent under the Banana Industry Protection Act, has been transferred to Townsville.

Mr. R. Kerwin, puntman at the Norman River Crossing, Normanton, has been appointed also an acting inspector of stock.

Mr. H. G. Knust, instructor in cane culture, Innisfail, has been appointed also an inspector under the Fertilisers Act.

Mr. T. W. Wall, curator of Queen's Park, Ipswich, has been appointed an honorary protector under the Fauna Protection Act.

Mr. N. G. Monroe, The Crescent, Coorparoo, has been appointed an inspector under the Diseases in Stock Acts, the Slaughtering Act, and the Dairy Produce Acts, Department of Agriculture and Stock, Brisbane.

Mr. F. J. Waring, Victoria Sugar Mill, Ingham, has been appointed millowners' representative on the Victoria and Macknade Local Sugar Cane Prices Boards, *vice* Mr. N. R. Dowling, resigned.

Mr. P. D. Parker, Courthouse, Mackay, has been appointed chairman of the North Eton, Cattle Creek, and Racecourse Local Sugar Cane Prices Boards during the absence of Mr. H. L. Kingston on recreation leave.

Mr. H. L. Hayles, Hassell street, Corinda, has been appointed an honorary protector of fauna.

Mr. H. H. R. Walker, inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from the Doboy Bacon Factory to Toowoomba.

Mr. A. H. Strohfeldt, inspector under the Stock, Slaughtering, and Dairy Produce Acts, has been transferred from the Oxley Bacon Factory to the Doboy factory.

Honey Board.

The existing regulations under the Primary Producers' Organisation and Marketing Acts covering the Honey Board levy have been rescinded, and new regulations empowering the Honey Board to make a levy on growers of honey and beeswax, and to exempt certain growers from the operation of that part of the Acts which provides that all the commodity shall be delivered to the board for sale by the board, have been issued in lieu thereof. The levy is at the rate of 1½ per cent. on all honey and/or beeswax sold during the period from the date of the issue of the regulations until the 8th March, 1944, and will provide for the administrative expenses of the Honey Board.

Arrowroot Board.

An Order in Council approved under the Primary Producers' Organisation and Marketing Acts amends the constitution of the Arrowroot Board to provide that persons eligible to vote at any election held after the date of this Order in Council shall be those who, during the twenty-four months immediately preceding the date of such election, supplied arrowroot bulbs grown in Queensland to the Board.

Citrus Levy.

The Citrus Levy Regulation issued in April, 1939, under the Fruit Marketing Organisation Acts and made by the Committee of Direction of Fruit Marketing on citrus growers has been extended for a further period of twelve months from 1st March, 1940.

Fauna Sanctuary at Mount Morgan.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937," declaring the area embraced within the external boundaries of Water Reserve R. 38, Mount Morgan, to be a sanctuary for the protection of fauna.

Canary Seed Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts amending the constitution of the Canary Seed Board to provide that the Board may authorise certain persons approved by the Minister to enter upon premises and inspect the books and accounts of any grower or person and to be supplied with such information as may be required.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts extending the operations of the Canary Seed Board for the period from 1st July, 1940, until the 30th June, 1943.

Regulations under the Pest Destroyers Act.

Regulations have been issued under "*The Pest Destroyers Act of* 1939" to give effect to the provisions of the Act. These cover the registration and analyses of pest destroyers.

Pest Destruction.

Appointments made under "*The Pest Destroyers Act of* 1939," which came into force from the 1st January, 1940, include those of Mr. F. B. Coleman, Officer in Charge of the Seeds, Fertilisers, Veterinary Medicines, Pest Destroyers, and Stock Foods Investigation Branch of the Department of Agriculture and Stock, to be the Registrar of Pest Destroyers; and Mr. R. A. Taylor, Inspector and Examiner in the abovementioned branch, to be the Deputy Registrar of Pest Destroyers.

Messrs. F. B. Coleman, R. A. Taylor, F. P. C. Bell, and R. J. Holdsworth have been appointed inspectors under the Act.

The following have been appointed members of the Pest Destroyers Board:—Messrs. E. H. Gurney, agricultural chemist; J. H. Smith, entomologist (plants); Dr. F. H. S. Roberts, entomologist (veterinary); Mr. J. H. Simmonds, pathologist (plants); Dr. J. Legg, pathologist (veterinary); and Mr. F. B. Coleman, officer in charge of the Seeds, &c., Branch.

Fruit Marketing.

An Order in Council has been issued under the Fruit Marketing Organisation Acts extending the operation of the provisions of the Acts for a period of five years from 1st January, 1940.

Brisbane Milk Board.

An Order in Council has been issued under "*The Milk Supply Act of* 1938," appointing the members of the second Brisbane Milk Board for the period from 1st February, 1940, to 31st January, 1943.

The members are—

E. H. Lindsey—Representative of the Government and chairman of the board.

M. Harland (Clayfield), E. E. Carson (Dayboro'), W. J. Smith (Branch Creek, via Strathpine)—Representatives of producers.

G. Andrew (Brisbane), R. H. Bentley (Margate), W. E. Bell (Milton)—Representatives of wholesale vendors.

Wild Life Preservation.

Mr. S. Head (Berry street, Toowoomba) has been appointed an honorary protector under the Fauna Protection Act.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937," declaring the pasturage reserve, Cape Edgecumbe, Bowen, to be a sanctuary for the preservation of wild life.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. C. T. White, Government Botanist.

Bracken.

C.V.H. (Toowoomba)—

The common bracken spreads by means of an underground rhizome which extends for some considerable length in the soil, branching freely, and which is a source of food material for the plant. If the leaves are continually kept down by scything, the roots eventually become exhausted of organic food material, and die out; but the scything must be done very frequently. Most people have found that, when not using poisonous sprays, it is better to break the fronds off with a stick or other blunt instrument, since when they do this a rot sets in and destroys the rhizome. Steers will eat the fronds usually without any ill-effects. In "The Farmer and Stockbreeder" (19th December, 1939), "Blythe," a regular contributor, has this note on pigs and bracken:—"During the last war I happened to be farming in a district where considerable areas of 'marginal' land had gone to bracken. Then, as now, we were urged to keep pigs on 'natural' lines, and I determined that the sows and gilts, at any rate, should work for their living. A portion of the bracken ground was fenced off and the pigs were turned in unrung. Bracken shelters were provided for them, and the pigs soon got to work on the bracken roots, and throve on them."

A Nutritious Grass.

C.S.C. (Toowoomba)—

The specimen is *Urochloa panicoides.* This grass has previously come under attention as a species with possibilities for controlling mint weed. It seems a rapid grower, and is said to be a highly palatable and nutritious grass. It seeds heavily, and it seems worth experimenting with.

Wistaria. Trees for Open Downs Country.

Inquirer (Charleville)—

Most people find the pruning of wistaria best done at the beginning of the deciduous time—that is, some time in June, and favour a cutting of them fairly hard back. Mr. Bick, the Curator of the Brisbane Gardens, says, where the plants make very long growths during the growing period, it is best to cut this back also, say, about half-way, soon after they start leafy growth, say, in early summer.

Regarding trees for the open downs, the following are suggested:—Kurrajong, White Cedar, Jacaranda, Portuguese Elm, Camphor Laurel, Citron Gum, Sugar Gum.

Wild Poppy, a Plant Poisonous to Stock.

E.M.K. (Westwood)—

The specimen represents *Pimelea hæmatostachya,* commonly known as wild poppy or red poppy, and generally regarded as a plant poisonous to stock. No feeding tests have been made with the present specie, but the genera *Pimelea* is a large one, and several are known definitely to be poisonous. The present one has a fairly wide distribution in Queensland and has a bad reputation.

A Plant Harmful to Horses (*Leucaena glauca*).

Inquirer (Townsville)—

The specimen is *Leucæna glauca,* a shrub, a native of tropical America, but now widely spread, either naturalised or cultivated throughout the tropics. It is very common throughout the South Sea Islands, where the seeds are sometimes woven into bags and other small articles. We were very interested in the statement that the plant was causing horses to lose the hair from their manes, tails, and legs. A similar observation has been made in other countries, but not, so far as we know, previously in Queensland.

Rural Topics

A Tribute to Australian Butter Quality.

As evidence of the marked improvement in the quality of Australian butter exported to Great Britain during the past three years, here is the opinion of Sir John Russell, the famous English agricultural scientist, who was a visitor to Queensland last year. In asking for an account of the methods of dairy production in Australia for publication in the "Empire Journal of Experimental Agriculture," he referred to the development of the present high quality of Australian butter as one of the most striking achievements in modern agriculture. Coming from an eminent authority like Sir John Russell, who for so many years has been closely associated with the butter markets of Great Britain, such an opinion is praise indeed. It should certainly act as a stimulant to all connected with the dairy industry to continue their efforts for further improvement of Australian butter generally.

Sir John Russell, by the way, thought so highly of the Queensland Agricultural College that he sent his son from England to be enrolled as a student at the College.

Why the Price Goes Up.

Farming is a more scientific business than it used to be. "Farm products," complained a townsman to his farmer friend, "seem to cost more than they used to. How's that?" "Well," admitted the farmer, "when a man has to know the botanical name of every crop he grows, the scientific name of every pest that eats it, and the chemical name of what will kill the pest, somebody's got to pay!"

Fertilizing for Better Vegetable Crops.

Bean growers in the Gosford-Wyong district of New South Wales have adopted fertilizer methods which are giving excellent results. They apply the fertilizer either in a band near to and on the same level as the seed, or in a band on one side of and below seed level.

This improved practice is based on the fact that the movement of fertilizers in the soil is mostly vertical rather than lateral. It would seem that fertilizers placed directly above the seed would be likely to cause injury to the seed when rain comes, while fertilizers placed immediately below the seed may have a worse effect during dry periods, when the moisture is evaporating at the surface. Because of the restricted lateral movement of the soluble salts in the fertilizer mixture, seed placed on one side of the fertilizer band is not affected by excessive concentration of the soluble salts, and by the time the roots reach the fertilizer much of its injurious effect will have vanished.

Dairying in Great Britain.

Here are some interesting facts which the national war effort in the Old Country has brought out: More than 150,000 farmers are engaged in dairying in the United Kingdom, and the yearly output of milk and milk products is valued at more than £60,000,000 sterling. And that huge sum is only a quarter of the annual value of the total production of British farms.

Another Way to Use Whey.

Here is the experience of a Maoriland farmer, as reported in "*The New Zealand Farmer Weekly*":—Additional feed may be put into pit silage by sprinkling whey over the fodder as it is stacked. The advantage of whey to the cheese factory supplier is that it costs nothing but the cartage. Where whey has been added to silage the product is better in every way and the silage turns out much greener. This is said to be probably due to lower fermentation with less loss of green colouring matter.

When Appetites are Tight.

At a demonstration on pig carcases recently a bacon factory supplier was heard to remark that "Some farmers seem to judge the appetite of their pigs by the amount of food they can conveniently carry." "Exactly," said another farmer, "just as many dairy farmers when feeding out in the paddock judge the appetite of their herd by the size of their cart."

Camera Records of Faked Brands.

The way of the transgressor is being made harder in America's ''wild west.'' In Wyoming, stock inspectors have been equipped with cameras as an additional aid in detecting doctored cattle brands. It is claimed that photographs of the brands on animals will generally reveal whether they have been altered in any way.

It seems a bright idea, but, camera or not, it would take an unusually expert brand ''doctor'' to get his beast past any Queensland brands inspector who has been reared in cattle country.

A New Freezing Process.

An interesting experiment was recently carried out at Smithfield Meat Market in London. Some English livers were subjected to a process of quick freezing, and then packed in cold store at a controlled temperature. That was done over a year ago. At the end of the twelve-month experiment period, the livers were taken from the cold store and defrosted. The livers were quite firm and retained their natural colour without any sign of bleaching. The usefulness of the process was proved when the livers showed no evidence of freezer ''burn,'' while, when cooked, they ate well and were very appetising.

The Value of Pastoral By-products.

Last year the value of skins, tallow, and other by-products of the pastoral industry in Australia was just on £8½ millions, or more than 8 per cent. of the gross value of all pastoral products for the year.

That is an indication of the importance of by-products to an industry, and the place they take in the economy of the Commonwealth.

The Dorset Horn Cross for Fat Lambs.

The advantages of the Dorset Horn cross for the early fat lamb trade has again and again been strikingly demonstrated. A line of New Zealand lambs drafted for sale recently, 85 per cent. of which were off their mothers, returned an average of 38.6 in weight. The oldest of the lambs was thirteen weeks, and the youngest twelve weeks.

That item of news will interest many farmers on the Darling Downs who are building up their fat lamb flocks largely on a Dorset Horn foundation.

Heavier Lambs Wanted.

With the demand by the British Government for a heavier lamb, some New Zealand lamb-raisers are becoming more interested in the Suffolk and Dorset Horn breeds.

Britain the World's Pedigree Stock Farm.

Being interested in the agricultural and stock position in war-time Britain and watching the trend of events on ''the other side,'' one comes across some very interesting and unusual facts at times. Going through the list of different breeds of livestock, one is amazed at the number—some of which we in Queensland rarely hear about. The British Isles have been termed the pedigree stock farm of the world; and rightly so, when one realises that it is the home of ninety-five distinct breeds of stock—to say nothing of the various crosses of these breeds.

The figures are: Four distinct breeds of heavy draught horses; sixteen light horse breeds; fifteen beef and dual-purpose cattle breeds; nine dairy cattle breeds; nine long-woolled sheep breeds; eleven Downs and other sheep breeds; thirteen mountain sheep breeds; twelve breeds of pigs; and six breeds of goats.

The remarkable thing is that each breed is flourishing and has a large following of ''fanciers.''

Cows with Head and Tail Lights for War Time " Black-outs."

The nightly ''black-out' in the Old Country is causing considerable anxiety to many stockowners. This is how one English farmer solved his difficulty:—

After several of his cows had wandered on to dark country roads at night and been killed by passing motor cars and trucks, he thought out a plan for placing head and tail lights on his cattle. Tiny lamps powered by small dry cells were fixed to the horns and tails of the animals, making them visible to motorists coming from either direction along the roads bordering his farm.

Farm Notes

MAY.

WHEN seasonal conditions permit, the May sowing of wheat is recommended in the Maranoa and Central districts, where early sown crops invariably outyield those established later in the season.

For the main Downs sowing, June is preferred unless sheep are available to check the early growth, as the principal varieties now grown, Flora, Florence, Pusa, Three Seas, Seafoam, and Gluyas, are all sufficiently quick maturing for early sowings to risk damage by frost. All seed wheat should be graded and treated with copper carbonate or a reliable mercury dust as a preventive of ball smut, utilising 1 to 2 oz. per bushel. Seed barley and oats are preferably treated with formalin, or with either of the mercury dusts agrosan and ceresan.

Succession sowings of oats, barley, or wheat required for grazing may be made during the month, with a mixture of field pea seed or tares, as described in previous issues of this Journal.

Winter grasses should now be well established. Land now in good condition may still be sown with suitable types, preferably *Phalaris tuberosa,* Wimmera rye, or prairie grass, all of which will withstand fairly dry conditions. Sowings later than May are not recommended.

Lucerne sowings may be continued, drilling the seed to a shallow depth only, on soil containing enough moisture for satisfactory germination. Rolling is beneficial if the surface is somewhat loose and rough, but should be followed by a light harrowing.

Potatoes will have received their final cultivation and hilling, so that cultivators may now be diverted to root crops, such as mangolds and swede turnips grown for pig feed.

The sowing of onion seed may be continued on suitable soils, drilling in their permanent position, in rows spaced from 12 to 15 inches apart, and lightly covering with not more than ½ inch of soil. Hand seeders are useful for this work if the areas are not large.

Mature sweet potatoes may be dug, allowed to dry in the sun for a few hours, and if desired for home use placed in dry sand until required. Sweet potatoes are mature when the cut surface dries white and does not turn greenish black round the edge.

Attention should be given to the important work of seed selection for future sowings before finalising the harvesting of maize, sorghum, sudan grass, cowpea, pumpkin, &c., as it is wise to be sure of varietal purity rather than depend on the seedsman from year to year.

◆

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Orchard Notes

MAY.

SUCCESS in fruitgrowing depends not only on the proper working and management of the orchard, but also on the way in which fruit is handled and marketed. With citrus fruits particularly, none pay better for extra care in packing and presentation.

Some growers do not realise how easily the skin of citrus fruits is injured, especially that of fruit grown under moist and humid conditions.

In order to prevent injuring skin when gathering, all fruit should be cut and not pulled. Any fruit that falls or is injured in any way should be rejected, as it is not fit to send to a distant market. If, however, the injury is only slight it may be sent to a local market for quick sale.

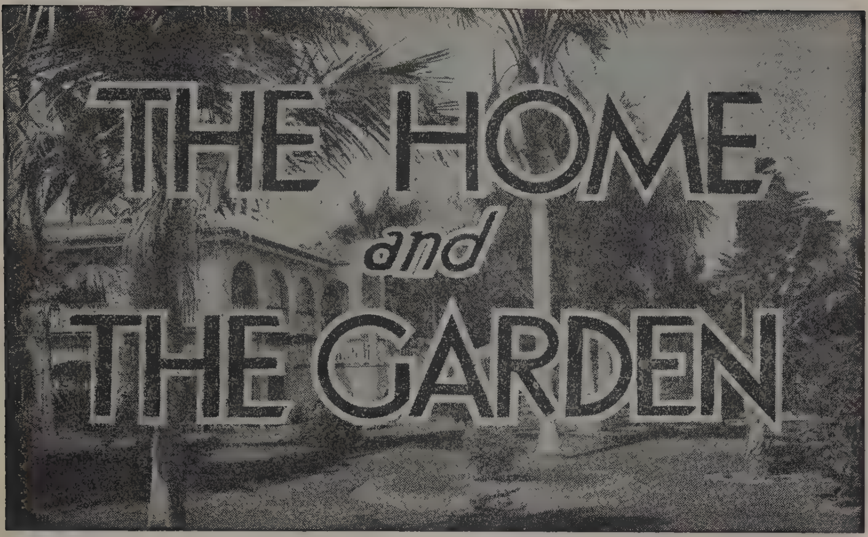
For oversea and interstate markets, only choice fruit should be selected. It should be graded for size, colour, and quality and properly packed, only one grade of fruit being packed in a case.

All orchards, vineyards, and plantations not completely clean should receive immediate attention.

Banana and pineapple plantations should be put into good order and kept free from weed growth.

Land to be planted with fruit trees should be got ready, for it is always advisable, if possible, to allow newly-cleared land to ''sweeten'' before planting.

Plate 125.
ROTARY HOE AT WORK IN THE CITRUS GROVE.—On Benyenda Orchard, near Gayndah.



Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

THE ONLY CHILD.

IN giving advice about the management of the only child for application in the home, we need to consider whether that home is in the city, small town, or isolated in the "outback."

There are two main points that parents should remember first; that all educationists and psychologists, who differ on many points, agree on one, namely, that character is formed before six years of age. After that, training and environment still count, of course, but not to the same extent. The second point refers especially to the only child, or one leading the life of the only child, and is that man is a social being.

Companionship with children of his own age or, better still, of his own stage of development is a necessary part of a child's life. Without it he has little opportunity of learning to make adjustments and is apt to become "a spoilt child." By adjustment is meant the process of learning how to fit harmoniously into a group of children, how to give and take for the good of the group, the process of acquiring judgment, balance, and control. In the light of future citizenship it means that the young child is learning to co-operate, to work for the good of the whole social group or community. He is gradually learning to put into practice the universal law of interdependence: interdependence of one individual upon another, of one part of the community upon another, of one nation upon another. Every intelligent teacher and parent has this in mind when training the baby or older child.

The best solution of the problem of the care of the child leading the life of an only child in the city is to send him to a nursery school or kindergarten. The trained director in charge is qualified to handle intelligently and sympathetically the various types of children who come under her supervision—the so-called difficult or problem child, the child over-attached to his mother, the irritable and emotionally unstable child, and others. The mother with a selfish and mistaken type of affection who is afraid to trust her child to the care of anyone but herself will be gratified to observe the improvement in her child after he has attended such a school. The child becomes more content as the result of his new interest, his emotional life is able to develop along healthy channels in his new environment, and his intellectual growth can take pace normally. To the onlooker it may seem that all the activity that goes on at the nursery school and kindergarten is just play. Behind it all growth and development are proceeding. Characters are being formed. The process is slow but sure. Attention is paid to the physical as well as the mental development. A sound mind in a sound body is the motto of the kindergarten.

There may be no nursery school or kindergarten in the town in which you live. In this case, social development being most important for your child, it may be possible to invite some children in to play. You can exercise supervision unostentatiously. If you are able to play just a little with them or show an interest in their play, or tell them a story, or read some nursery rhymes to them, how they will love you! Perfect English is not maintained under normal circumstances anywhere while children are young and imitative. Mistakes in grammar, even "swearing," appear for short intervals in all well-conducted homes and schools; children love to imitate anything new.

For the parents of a solitary child in the "outback" there is often only one solution of the problem—the mother or guardian must give up much time, at the cost of some other duties, to give the child companionship. But the companionship must aim at strengthening, not weakening, the child. Let all games, all "jobs," all enjoyments, keep as near a fifty-fifty basis as possible. Train the child to be a "good loser." Develop responsibility by letting him keep pets and have entire control of their welfare. For mental culture, good books with clear pictures are essential. Handwork, be it connected with small house duties, carpentry, drawing, or other activities, is useful in helping to keep the only child practical. Aim always at turning his thoughts outwards, away from himself. Any creative work should be steadily encouraged; finishing things started is an important part of efficiency, so guide him to start only things simple enough to finish. Above all, if the parents co-operate and "pull together," then wherever the only child may be living he has the greatest help of all—the unified, harmonious home.

Bring your toddlers as well as your babies to the Baby Clinics for advice and for periodic examination and weighing.

Information on all matters concerning child welfare may be obtained by visiting the nearest Baby Clinic, by writing to the Sister in Charge, or by communicating direct with the Baby Clinic Training Centre, Alfred street, Valley, N. 1, Brisbane.

IN THE FARM KITCHEN.

"SMOKO" DAINTIES.

Cherry Drops.

Take 1 egg, 2 oz. butter, 2 oz. flour, 1½ oz. castor sugar, ½ teaspoonful baking powder, 1 dessertspoonful lemon juice, 1 oz. glace cherries.

Cream the butter, add the sugar, and beat till soft and white. Beat in the egg and lemon juice, add the flour, and last of all stir in the baking powder. Half-fill four to six paper baking cases and bake in a quick oven for about ten minutes.

Four O'clock Tea Biscuits.

Take ¼ lb. flour, 1 egg-yolk, 2½ oz. butter, 2½ dessertspoonfuls castor sugar, ½ flat teaspoonful ground cinnamon, 3 oz. currants and sultanas (mixed), ½ small lemon rind only.

Wash, dry, and pick over the fruit, and put it through the mincer. Work ½ oz. of the butter until soft and creamy, add the finely-grated lemon rind, one dessertspoonful sugar. the cinnamon, and prepared fruit, and mix all together. Rub the rest of the butter into the sifted flour, add the remainder of the sugar. Beat the egg-yolk and mix it with a teaspoonful of water and add it, and mix all to a stiff paste, adding a little more water as required. Roll it out and cut into rounds. Take half of them and put the prepared fruit mixture in the centre, damp the edge, and cover each with another round, pressing it down lightly. Make two cuts in the centre, brush the tops with water, sprinkle them thickly with castor sugar, then put them on a baking sheet and bake them in a quick oven from ten to fifteen minutes.

Shortbread Fingers.

Take ¼ lb. butter, ¼ lb. lard, 1 egg, 1½ cupfuls flour, ½ teaspoonful baking powder, 1 cupful castor sugar.

Sprinkle a little flour on the baking board. Place the butter and lard on the board. Work in the flour and sugar, sifted with baking powder. As the mixture becomes a lump, moisten with half of a well-beaten egg. Roll out smoothly about a quarter of an inch thick. Cut into strips 1 inch by 3 inches. Place on a greased baking sheet and bake in a moderate oven for fifteen minutes. When almost cold, brush over with the remainder of the egg and sprinkle thickly with sifted sugar.

Ginger Crisps.

Take 3½ cupfuls flour, 1 teaspoonful salt, ¾ tablespoonful ground ginger, ¼ teaspoonful ground mace, 1 cupful golden syrup, ½ cupful butter, ¼ tablespoonful ground cinnamon, ¼ teaspoonful baking soda.

Grease a baking sheet or tin. Measure the butter into a basin. Heat the syrup till tepid, then stir into the butter. Mix in the dry ingredients. Stand aside till quite cold. Knead well. Turn on to a lightly-floured pastryboard. Roll out very thinly. Cut into rounds with a cutter dipped in flour. Bake in a very hot oven for five minutes. Turn out and cool on a cake rack.

Cinnamon Slices.

Take ½ lb. flour, 4 level teaspoonfuls baking powder, pinch of salt, 1 oz. butter, 2 level tablespoonfuls castor sugar, 1 egg-yolk, ¾ gill milk, ground cinnamon, and castor sugar.

Sift the flour into a basin with the baking powder, salt, and sugar. Work in the butter with the tips of the fingers. Add the beaten egg-yolk, mixed with a little milk. Knead the dough for a few minutes on a well-floured board. Roll into an oblong shape a good fourth of an inch thick. Spread the rolled-out dough with a layer of soft butter (extra to that given in the ingredients). Sprinkle the butter with the cinnamon and castor sugar. Roll up the dough like a Swiss roll. Cut the roll into thick slices. Bake the slices in greased tins in a hot oven.

Bridge Biscuits.

Take 3 oz. castor sugar, 4 oz. butter, 5 oz. flour, ¼ level teaspoonful baking powder, 1 egg-yolk, large pinch cinnamon.

Beat the sugar and butter to a cream, stir in the egg-yolk, and beat well. Add the flour, sifted, with baking powder and cinnamon. Mix all together to a soft paste. Roll the paste out thinly and stamp it into shapes with bridge cutters. Put the biscuits on a lightly-buttered tin and bake them in a moderately hot oven for about ten minutes. Cool the biscuits on a sieve or cake cooler and dredge them with castor sugar.

Almond Balls.

Take 3 eggs, 8 oz. sugar, 4 oz. almonds.

Beat the eggs and sugar well together and add the chopped almonds and flour. Allow the mixture to stand for a few hours. Make the mixture into small balls and roll them in granulated sugar. Bake the almond balls in a good oven.

Cornish Rock Cakes.

Take ½ lb. self-raising flour, ¼ lb. castor sugar, 1 egg, milk, 1 lemon rind, ¼ lb. butter, 1 tablespoonful mixed peel, 6 oz. cleaned currants, salt.

Rub the butter into the sifted flour. Stir in the sugar, a pinch of salt, grated lemon rind, currants, mixed peel, and beaten egg, and a little milk if required. but the mixture must be stiff. Place the mixture on a butter baking sheet in little heaps an inch or two apart. Sift castor sugar on top and bake the cakes from fifteen to twenty minutes in a hot oven.

Soda Biscuit Rings.

Take 2 oz. butter, 2 oz. sugar, 3 oz. unsweetened tinned milk, 4 oz. flour, 4 oz. cornflour, ½ level teaspoonful bicarbonate of soda.

Beat the butter and sugar until creamy, and add the beaten tinned milk. Add gradually the cornflour and flour sifted with the soda. Roll out the mixture, prick it, and cut it into small round biscuits. Cut a small hole in the centre of each, using a thimble or small cutter. Bake the biscuits in a moderate oven for from eight to ten minutes.

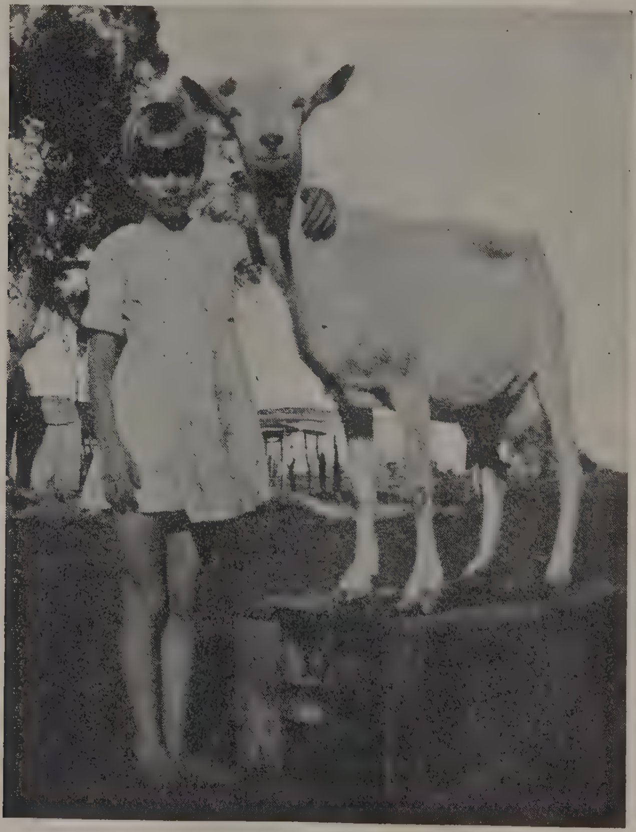


Plate 126.

PALS.—In many parts of Western Queensland, particularly in mining centres, the goat is a domestic necessity as the supplier of rich, wholesome milk.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of February in the Agricultural Districts, together with Total Rainfall during 1940 and 1939, for Comparison.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Feb.	No. of years' records.	Feb., 1940.	Feb., 1939.
North Coast.	In.		In.	In.
Atherton	11·23	39	17·10	29·56
Cairns	16·13	58	17·11	38·63
Cardwell	17·01	68	22·39	21·87
Cooktown	13·84	64	8·28	21·66
Herberton	8·29	54	20·52	17·95
Ingham	16·72	48	29·22	28·15
Innisfail	23·02	59	17·87	38·18
Mossman Mill	19·18	27	..	35·13
Townsville	10·39	23	23·73	9·48
Central Coast.				
Ayr	9·37	53	20·87	18·20
Bowen	8·77	69	25·16	10·01
Charters Towers	4·50	58	12·28	5·65
Mackay P.O.	11·80	69	37·20	11·78
Mackay Sugar Experiment Station	11·28	43	38·62	14·45
Proserpine	12·91	37	43·60	27·90
St. Lawrence	7·59	69	11·38	1·36
South Coast.				
Biggenden	4·23	41	2·58	2·29
Bundaberg	6·36	57	9·02	2·36
Brisbane	6·28	88	7·98	2·61
Caboolture	7·58	53	7·87	1·62
Childers	6·50	45	5·54	2·74
Crohamhurst	12·41	47	10·51	4·45
Esk	5·25	53	6·87	0·38
South Coast—contd.	In.		In.	In.
Gatton College	3·36	41	5·10	0·33
Gayndah	4·12	69	7·40	1·25
Gympie	6·65	70	4·65	1·79
Kilkivan	4·80	61	5·80	2·15
Maryborough	6·66	69	6·15	2·05
Nambour	9·42	44	13·88	3·23
Nanango	3·93	58	5·05	0·79
Rockhampton	7·58	69	11.81	3·37
Woodford	8·19	53	5·96	2·83
Central Highlands.				
Clermont	4·15	69	12·45	0·77
Gindie	2·68	41	7·10	2·71
Springsure	3·75	71	8·60	1·50
Darling Downs.				
Dalby	2·76	70	5·27	1·94
Emu Vale	2·45	44	5·99	..
Hermitage	2·31	33	4·96	..
Jimbour	2·52	52	5·88	1·18
Miles	2·60	55	7·14	0·50
Stanthorpe	3·08	67	6·72	0·28
Toowoomba	4·42	68	5·21	0·94
Warwick	2·98	75	5·46	1·05
Maranoa.				
Bungeworgorai	2·10	26	..	..
Roma	2·83	66	8·62	0·13

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—FEBRUARY, 1940.

Compiled from Telegraphic Reports.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·70	88	75	93	24	71	9	828	19
Herberton	..	80	67	86	24	63	14	2,052	25
Rockhampton	29·81	87	74	99	1, 23	69	8,10-13,	1,181	17
Brisbane	29·91	84	70	104·6	23	65·2	10	798	8
Darling Downs.									
Dalby	29·91	87	65	103	23	58	11	527	9
Stanthorpe	..	81	58	94	23	50	11	672	8
Toowoomba	..	81	63	98	23	55	12	521	10
Mid-Interior.									
Georgetown	29·70	88	73	95	15	70	9, 14, 19	1,524	22
Longreach	29·77	90	72	101	1	63	29	1,144	10
Mitchell	29·85	88	69	101	23, 24, 25, 26	60	29	552	8
Western.									
Burketown	29·70	89	76	99	18, 19	61	29	1,189	16
Boulia	29·76	90	72	100	5, 17, 18	60	29	996	8
Thargomindah	29·82	96	74	106	27	58	29	23	1

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

					MOONRISE.	
	April, 1940.		May, 1940.		April, 1940.	May, 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					a.m.	a.m.
1	6·2	5·50	6·18	5·20	12·9	12·40
2	6·3	5·49	6·18	5·19	1·3	1·31
3	6·3	5·48	6·19	5·19	1·54	2·21
4	6·4	5·47	6·19	5·18	2·42	3·11
5	6·4	5·46	6·20	5·17	3·34	4·3
6	6·5	5·45	6·21	5·17	4·27	4·53
7	6·5	5·43	6·21	5·16	5·14	5·48
8	6·6	5·42	6·22	5·15	6·9	6·41
9	6·7	5·41	6·22	5·15	7·2	7·34
10	6·7	5·40	6·23	5·14	7·53	8·28
11	6·8	5·39	6·23	5·13	8·46	9·22
12	6·8	5·38	6·24	5·13	9·40	10·13
13	6·9	5·37	6·25	5·12	10·33	11·1
14	6·9	5·36	6·25	5·11	11·24	11·48
					p.m.	p.m.
15	6·10	5·35	6·26	5·10	12·17	12·32
16	6·10	5·34	6·26	5·10	1·3	1·15
17	6·11	5·33	6·27	5·9	1·50	1·58
18	6.11	5·32	6·28	5·9	2·34	2·40
19	6·12	5·31	6·28	5·8	3·17	3·24
20	6·12	5·30	6·29	5·8	4·3	4·11
21	6·13	5·29	6·30	5·7	4·49	5·2
22	6·13	5·28	6·30	5·7	5·34	5·53
23	6·14	5·27	6·31	5·6	6·23	6·48
24	6·14	5·26	6·32	5·6	7·15	7·45
25	6·15	5·25	6·32	5·6	8·9	8·42
26	6·15	5·24	6·33	5·5	9·4	9·38
27	6·16	5·24	6·33	5·5	10·0	10·31
28	6·16	5·23	6·34	5·5	10·54	11·20
29	6·17	5·22	6·35	5·4	11·49	..
						a.m.
30	6·17	5·21	6·35	5·4	..	12·12
31	..	..	6·36	5·3	..	1·3

Phases of the Moon, Occultations, &c.

8th April	○	Full Moon	6 18 a.m.
15th ,,	●	New Moon	11 46 p.m.
22nd ,,	☽	First Quarter	2 37 p.m.
29th ,,	☾	Last Quarter	5 49 p.m.

Apogee, 5th April, at 7.0 p.m.
Perigee, 21st April, at 5.0 a.m.

At moontime on the 9th Saturn and a very narrow crescent of the Moon will be very near the western horion shortly after sunset.

Jupiter, which in September last was in "Opposition"; rising as the Sun sets, will be in "Conjunction," on the opposite side of the Sun from the Earth, on 11th April, lost to the evening sky.

Other interesting phenomena will also occur on the 11th: Venus, having passed Saturn in March, will overtake Mars; the Moon, which will be in conjunction (at the same celestial longitude) with both planets at 5 a.m., will be seen very near them before they disappear in the west.

On the 12th, Mercury, a morning star, will attain its greatest altitude, 28 degrees, west of the Sun, and on the 17th Venus will be at its greatest distance, 46 degrees, above the western horizon at sunset, but while it loses altitude from this date on it will increase in brightness.

Saturn will be in conjunction with the Sun on the 24th and also disappear from view.

Mercury rises at 4.14 a.m., 1 hr. 48 min. before the Sun, and sets at 4.42 p.m., 1 hr. 8 min. befor it on the 1st; on the 15th it rises at 4.4 a.m., 2 hr. 6 min. before the Sun, and sets at 4.25 p.m., 1 hr. 10 min. before it.

Venus rises at 9.30 a.m., 3 hr. 28 min. after the Sun, and sets at 8.4 p.m., 2 hr. 14 min. after it, on the 1st; on the 15th it rises at 9.45 a.m., 3 hr. 35 min. after the Sun, and sets at 8.2 p.m., 2 hr. 27 min. after it.

Mars rises at 9.45 a.m., and sets at 8.21 p.m. on the 1st; on the 15th it rises at 9.33 a.m. and sets at 8.2 p.m.

Jupiter rises at 6.38 a.m. and sets at 6.18 p.m. on the 1st; on the 15th it rises at 6.0 a.m. and sets at 5.31 p.m.

Saturn rises at 7.32 a.m. and sets at 6.58 p.m. on the 1st; on the 15th it rises at 6.46 a.m. and sets at 6.9 p.m.

Venus and Mars will be in Taurus, northward of the bright star Aldebaran in the V-shaped cluster, on the 15th, both planets setting at the same time, 2 hr. 27 min. after the Sun.

7th May.	●	New Moon	10 7 p.m.
15th ,,	☽	First Quarter	6 51 a.m.
21st ,,	○	Full Moon	11 33 p.m.
29th ,,	☾	Last Quarter	10 40 a.m.

Apogee, 3rd May, at 9.0 a.m.
Perigee, 19th May, at 5.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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QUEENSLAND AGRICULTURAL JOURNAL

Vol. LIII. 1 MAY, 1940 Part 5

Event and Comment.

Anzac.

ANZAC Day this year was commemorated throughout Australia with greater solemnity than on any previous occasion since "cease fire" sounded in 1918. To-day, young men—many of them the sons of old Diggers, including Gallipoli veterans—are going forth with magnificent courage and self-sacrifice to face an enemy who has blown to bits all the dreams of a better world, the hoped-for outcome of the last "war to end war." So Anzacs are again in Egypt and Palestine to continue the conflict against ruthless aggression which it was thought had ended with the armistice, an armistice which, as events have proved, lasted until September, 1939, when, again, the "lights went out all over Europe." There is no half-way house in a fight against the forces of evil, and we have come to one of those times in history when compromise is useless. To the new Digger, then, the old Digger has handed the torch in the knowledge that modern warfare is no gay adventure, yet with unfaltering faith in ultimate victory for the cause of human freedom, a cause which inspired the Anzac tradition than which the new A.I.F. could have no nobler heritage.

The Realities of War.

IN the course of a recent address, the Premier, Hon. W. Forgan Smith, LL.D., said that from the viewpoint of our citizenship, we are just as much concerned individually as the people who live in the British Isles or in any other part of the British Commonwealth of Nations. We are all concerned in the war and we must all give our support in order to be victorious. We must free the world from aggression or from the danger of aggression. We must prize justice and reason and have those principles enthroned, rather than that of force. Reason and justice prevail and can live always. There is nothing permanent about force. What is won by force to-day can be taken by a superior force tomorrow, and only those things live and become part of the national character which are brought about by the common consent of the minds and souls of the nation to which we belong.

He personally had no doubt of the result, but he did not underestimate the road we must travel before victory is ours. "We must win the war. We must conquer Germany, otherwise Germany will conquer us, and we will be forced to live under a form of social order other than the one we know and love so well," continued the Premier. "We must not only win the war, but we must win the peace so that the children who are growing up to-day and their children, and their children's children, shall not be torn with the grief, the suffering, and the sorrow of this generation. All of these things must come to pass. They will come to pass if we are strong enough, and if we work hard enough to achieve them. Nothing in life is worth while that is not obtained by honest effort. All wealth is the result of the application of human effort intelligently applied to the resources that Divine Providence has bestowed upon us. That is the basis of all wealth.

"There are some patent medicine vendors in the community to-day who think they have a substitute for work. There is no such substitute, and I personally have never looked for one. I do not regard work as being the curse of Adam. Work is God's greatest gift to mankind. Society can be so organised that men and women will have happiness and enjoyment in their work and shall be protected in the enjoyment of the fruits of their industry so that they shall grow bearing those blossoms of grand characters that delight the hearts of God and man. All those things can be brought about. The best of men and women have always worked towards those ends.

"We require idealism, harnessed to strong resolution. Idealism shines like the star in the heavens by which the mariners set their course. So, therefore, let us all have our ideals. Ideals of themselves, however, are valueless unless they are accompanied by strong resolve.

"You must have the resolution to work and struggle towards the objectives you seek to obtain. I repeat, there is no substitute for work. Very comfortable, if all those things could be written on a piece of paper or be done by a prescription. It might be all right for a while, but my experience in life, and I have no doubt the experience of all, is that everything must be paid for. Sometimes you pay for it in money; sometimes you pay for it in blood and tears; but whatever the price may be, you pay somewhere, somehow, some day.

"It is a great privilege to be connected with the Government of a State," the Premier added. "It is a splendid thing to be associated with others in the development of almost virgin lands. Developing a country, seeing farms, industries, and buildings growing up, population expanding and growing during your own lifetime, is a wonderful privilege and a tremendously great and grave responsibility."

Queensland's Progress.

CONTINUING, the Premier said that Queensland is a State the value of which cannot be overstated. The white population is 1,020,000, and as the population increases we will likely overtake the population of New Zealand at no distant date.

The State of Queensland is expanding very rapidly. Those things are not happening by accident. They are happening because of long-range planning and the continued effort of the citizens of the State. A great majority of the people are highly intelligent. A very good basis to start on. They are also very industrious and have a habit of work very well developed. So with that intelligence and industry, we are bound to prosper.

Queensland's Rural Wealth.

QUEENSLAND'S primary industries in 1939-40 will be worth more to the State than ever before in its history. It is estimated that the four chief products—sugar, wool, butter, and meat—will have a combined value of £44,000,000, about £4,600,000 more than in 1938-39.

Distribution of this huge sum throughout the State has been the main factor in maintaining record prosperity. Aggregate cheques for the four main products compare as follows:—

	1938-39.	1939-40.
	£	£
Sugar	11,750,000	13,800,000
Wool	8,000,000	10,700,000
Butter	9,650,000	9,000,000
Meat	10,000,000	10,500,000
	£39,400,000	£44,000,000

The cheque to sugar interests sets a new record with an increase of £2,000,000. Sugar maintains its position as the State's most valuable product. This year wool has replaced butter in the size of cheques. Returns from wool will total about £10,700,000, an increase of £2,700,000.

The butter cheque may be from £9,000,000 to £9,500,000, depending on weather conditions in the next few weeks. At the lower estimate, this is a fall of £650,000 on last season's record distribution.

Reliable estimates for meat are not available, but the favourable conditions in this trade have been well maintained.

Fused Needle Disease and its Relation to the Nutrition of Pinus.

H. E. YOUNG, M.Sc.Agr., Assistant Research Officer.

(*Continued from p. 392, April, 1940.*)

(V.) A CARBOHYDRATE HYPOTHESIS FOR THE SIGNIFICANCE OF MYCORHIZAS AND THE CAUSE OF FUSED NEEDLE DISEASE.

Discussion of Physiological Basis.

IT was early considered by the author that the effect of litter dressings in promoting vigorous growth of *Pinus* and in this way causing a recovery from fused needle disease might possibly be due to the provision of carbohydrates by the fungus in a state assimilable by the higher plant. It has been known for a considerable time that, in the asymbiotic culture of orchids, a supply of carbohydrates in a form suitable to the plants must be made available in the substratum for satisfactory growth to take place (Knudson 1922, Wynd 1933). It was also made evident that orchids could grow in the absence of sunlight when supplied with the necessary sugars in the substratum. The nonchlorophyllous plants, cited previously, also obtain their carbohydrates from the mycorhizal systems of their roots.

Calletet (1911), Maquenne (1911), Molliard (1912), Polacci (1917-1920), Breazeale (1923), Banal (1926, *cf.* Miller, 1931), and Falck (1923, *cf.* Melin, 1925) have obtained evidence that plants are able to absorb and utilize carbon dioxide from the soil. Polacci grew plants in a carbon dioxide-free atmosphere, but with their roots in humus rich soil or in nutrient solutions containing carbon dioxide, and observed that plants of *Zea mays, Acer pseudoplatanus* and *Quercus æsculus* lived under these conditions and were able to store starch. It is noteworthy that all these plants have been observed to form mycorhizas. Falck in 1923 demonstrated by culture experiments with young pines that the plants could grow satisfactorily in carbon dioxide-free air when supplied with mycorhiza and raw humus. Plants free from mycorhiza or lacking organic substrates would not grow.

In 1889 Acton (*cf.* Miller, 1931) supplied various carbohydrates and glycerin to a number of plants growing in water cultures, including *Acer pseudolplatanus, Phaseolus vulgaris, Quercus robur,* and *Euphorbia hirsuta,* and found that glucose, saccharose, and glycerin were absorbed and utilized in the dark by these plants in the formation of starch, but that glycogen, dextrin, and soluble starch were not used. Similarly, Laurent in 1904 showed that corn, beans, and other plants could absorb glucose through their roots and use it. This was indicated by the formation of starch in their leaves. The same results were also obtained by Mazé and Perrier in 1904 for corn grown in water cultures.

Knudson (1916) investigated the influence of carbohydrates on plant growth by growing plants in an agar medium to which Pfeffer's nutrient solution and a sugar solution varying in concentration from 1 to 2 per cent. had been added. He measured the effect of the sugars by the dry weights of the treated plants, and found that corn was able to absorb glucose, fructose, saccharose, and maltose through its roots and to utilize these substances. The relative beneficial effects were in the order quoted. Field peas, timothy, vetch, and radish were also benefited by the addition of sugar to the cultures.

Robbins in 1918 grew the moss plant *Ceratodon purpureus* on a sterile culture medium, and found that carbohydrates, in the form of lævulose, glucose, galactose, lactose, sucrose, and maltose, were absorbed and used, as was evidenced by starch formation in the plant in the dark. Mannite, glycerin, and starch, however, could not be used. With lævulose a greater amount of growth occurred in the dark than in the light; with glucose the reverse was the case.

Brannon (1923, *cf.* Miller, 1931) obtained evidence to show that different species of plants differ as to the kind of sugar they are able to use most efficiently. Lucerne grew best in glucose solutions, whilst timothy fared better with fructose. Radish used both equally well. It seems that all the plants experimented with can use glucose and sucrose to some extent, whilst galactose, mannose, and fructose have been shown to be toxic to some plants.

The evidence that green plants are able to absorb and use carbohydrates by means of their roots is based in many cases upon their behaviour in the dark. Albino plants, which occur as sports in numerous species, form excellent material, and Knudson and Lindstrom (1919) studied the effect of sugars on the duration and growth of albino corn plants. With sucrose present in the culture medium, the plants showed an appreciable gain in weight during a fifty-five day experiment, whilst those grown in a sugar-free solution showed a loss and died twenty-five days sooner.

The Significance of Carbohydrate Assimilation in Mycotrophy and its Application in Connexion with Fused Needle Disease.

From the results obtained by the workers mentioned above there appears to be good evidence that a green plant may absorb carbon compounds from the soil and thus supplement the supply obtained from the air. This being so, there appears to be no reason for not drawing the conclusion that the response of the trees to the litter application in the experiments at Beerwah is due to the reaction resulting from an increased carbohydrate supply made available.

Ludbrook (1937) and the author have both noted the more frequent appearance of starch in healthy trees than in trees suffering from fused needle disease. The author has also noted this comparative absence of starch in trees of poor growth on poor sites which come within the broader conception of fused needle. This fact can perhaps be correlated with the classification of mycotrophic plants into sugar plants and non-mycotrophic into starch plants, as was done by Stahl in 1900. Stahl found that mycotrophic plants were characterized by the relative absence of starch from the leaves, and non-mycotrophic ones by its presence. In the fused needle condition the absence of starch from the needles of diseased trees is thought to be due to the absence of the accessory carbohydrate supply which would be produced by healthy mycorhizas. In healthy plants, where both roots and foliage are working efficiently, enough carbohydrate would be elaborated to make its appearance in the leaves as the storage product starch; the phosphate supply, which is also essential for normal growth, would aid in the translocation of the carbohydrate and promote active fungal growth. It is considered that the carbohydrate supplied by the mycorhiza is obtained from cellulose. Sugar is the first breakdown product of cellulose (Thaysen and Bunker, 1927), and the cellulose is present in the leaf litter. In this also may lie one of the factors making a supply of fresh litter necessary for healthy growth, as a continual supply of undecomposed cellulose would then be available.

The concept of the higher plant obtaining carbohydrate from its fungus symbiont is in direct contradiction to the unsupported but generally assumed theory that the mycorhizal fungi obtain carbohydrate from the tree roots as their share of the symbiotic relationship. The hymenomycetous fungi which form the mycorhizas are, however, quite capable of obtaining their own carbohydrate supply from the breakdown of organic matter. This is evidenced by their vigorous growth on raw organic substrata and is supported by the experimentally proved fact that one of the major functions of the fungi associated with orchid roots is to supply carbohydrate to the higher plant.

It must not be understood that it is here contended that the only significance of mycorhiza is carbohydrate transference. Inorganic salts and perhaps nitrogen compounds are probably also supplied to the plant, but it is thought that the carbohydrate factor is the limiting one in so far as fused needle disease is concerned. During the course of these experiments further evidence supporting this theory was obtained.

Experimental Evidence Bearing on the Carbohydrate Hypothesis.

(a) Carbohydrate Treatment Experiments.

In order to gain evidence concerning the carbohydrate deficiency theory, it was decided to conduct a series of experiments involving the injection of diseased pine trees with carbohydrates. The experiments were carried out during the 1937-38 growing season at Beerwah.

The method of injection used was by medium of the roots. A suitable severely affected fused needle tree was selected for each trial. The symptoms in all cases were those of the typical form of the disease. The trees were *Pinus caribæa* and *P. tæda* and varied from 5 to 7 feet in height and were not suffering from the effects of suppression by neighbouring trees. For injection purposes a root one-half to three-quarters of an inch in diameter at a distance of about 1 foot from the base of the tree was carefully dissected from the soil. The root was then cut so as to leave a stump approximately 1 foot long attached to the butt of the tree. A piece of rubber tubing about 3 feet long was then fitted over the end of the root stub and secured by twitching a piece of wire around the junction. A filter funnel was fitted into the free end of the tube and secured in an upright position to the trunk of the tree. The funnel was covered by a petri dish closely fitting over it. The petri dish was lined with paper so as to act as a shade from the sun. In all, twelve trees were thus fitted up in the plantation.

The carbohydrates used were lævulose, dextrose, saccharose, and mannite. It has been shown by Wynd (1933) that only dextro-rotary sugars are acceptable to orchid plants as a source of carbohydrate in pure culture experiment. On this account both dextro and lævo-rotary sugars were included in the treatments in this experiment, as well as mannite, which was used as an example of another organic carbon source which is found widely distributed in plant tissue.

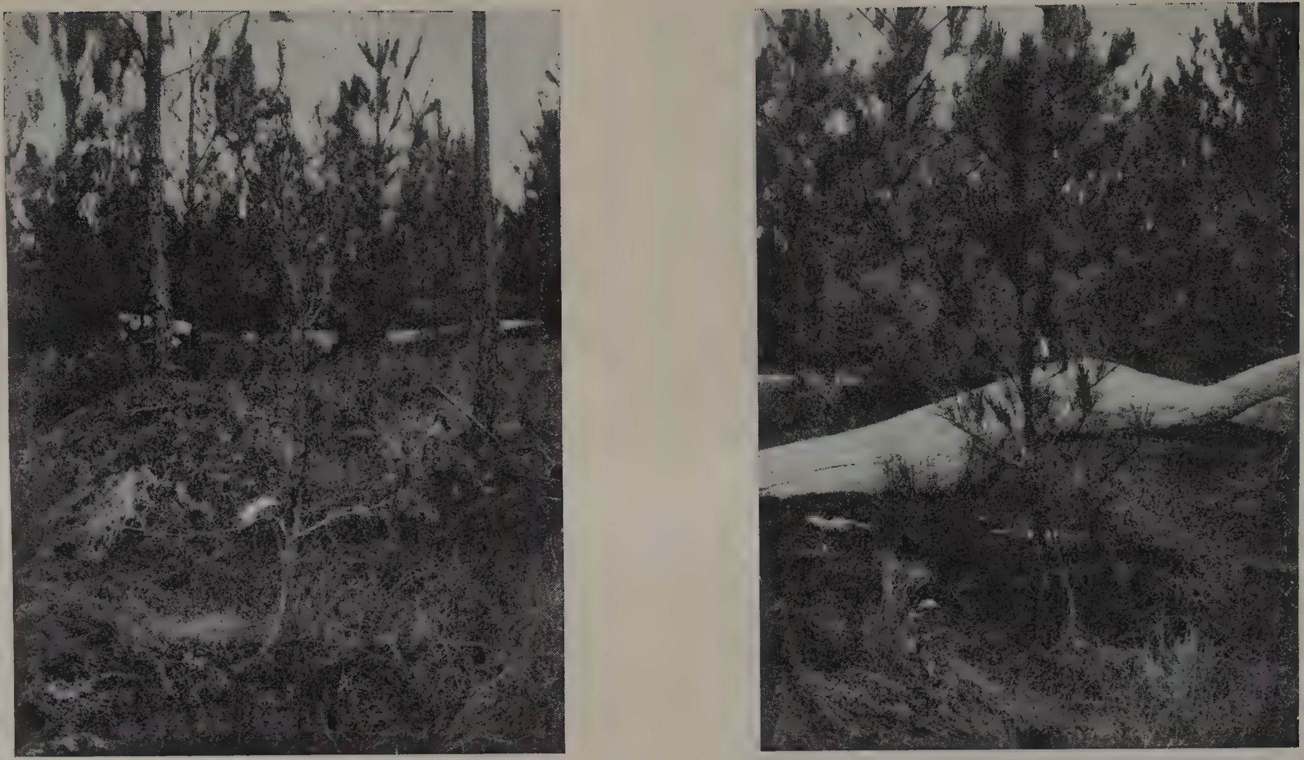

Plate 127.

The Effect of Carbohydrate Injections on Fused Needle Affected *Pinus tæda.*—Left: Mannite injection with no effect. Right: Saccharose injection causing recovery.

The carbohydrates were used in the form of 2 per cent. solutions in distilled water. It was found that the glass funnels and rubber tubes used in the injection apparatus had to be attended to every other day. At the time of each refilling the tubes and funnels were rinsed in distilled water and fresh solution was added. On the average, each tree absorbed 100 cubic centimetres of 2 per cent. carbohydrate solution in each two-day period. At intervals the ends of the cut roots were trimmed back in order to expose a fresh absorbing surface so as to facilitate the uptake of the solutions. The treatments were carried out over a period of three months during which the trees were making active growth. The average amount of carbohydrate absorbed per tree during this period was eighty-four grammes. Photographic and written records of the condition of the trees used in the experiment were made at intervals until the end of the growing season, when the injections were stopped.

In the case of saccharose a definite response was obtained from all three of the injected trees (Plates 127 and 128). The new growth commenced earlier than in the case of the controls and was of the normal type and length. Previous to the treatment all the needles on the trees were badly twisted together and shortened and much resinosis and dieback of the leading shoots was present. The growth after treatment showed an absence of resinosis with a normal length of needle and no malformations. A less marked but observable response was made by the dextrose-treated trees. In this case the new needles were longer than the old ones; there was little fusion present, but some twisting. Resinosis ceased. The amount of growth during the period was good. No response was obtained from the lævulose and mannite treatments, all the trees involved in these two injection experiments continuing in a badly diseased state. No change was noted in the condition of the trees used as controls during the period of the experiment.

The failure of the trees to produce a reaction to the lævulose treatment is in agreement with Wynd's findings in the case of orchids where lævo-rotary sugars were found to be unavailable to the plant. In 1918 Robbins showed that mannite could not be used by the plants which he treated with that substance, and the present instance is comparable with this.

Twelve months after the commencement of the experiment the trees involved in the treatments were again examined and it was found that all of the trees were then in as bad a state as before the injections were carried out. This was particularly noticeable in the case of the saccharose-treated trees, which had made a marked recovery during the period of treatment. It would appear from this that the response obtained is one which requires the constant presence of the sugar rather than one which is due to a single stimulation.

A series of needle-fused plants were cultivated in sand in earthenware pots and were used for experimental purposes with carbohydrate. In this experiment the plants were watered twice each week with a 2 per cent. cane-sugar solution. The watering was continued over a period of two months. There was no response to this treatment on the part of the plants. Unsatisfactory soil conditions developed owing to the rapid fermentation of the sugar supplied, and it is probable that little of the sugar as such would find its way into the plants.

The result of the injection experiments provides a considerable amount of support for the carbohydrate-deficiency hypothesis for the

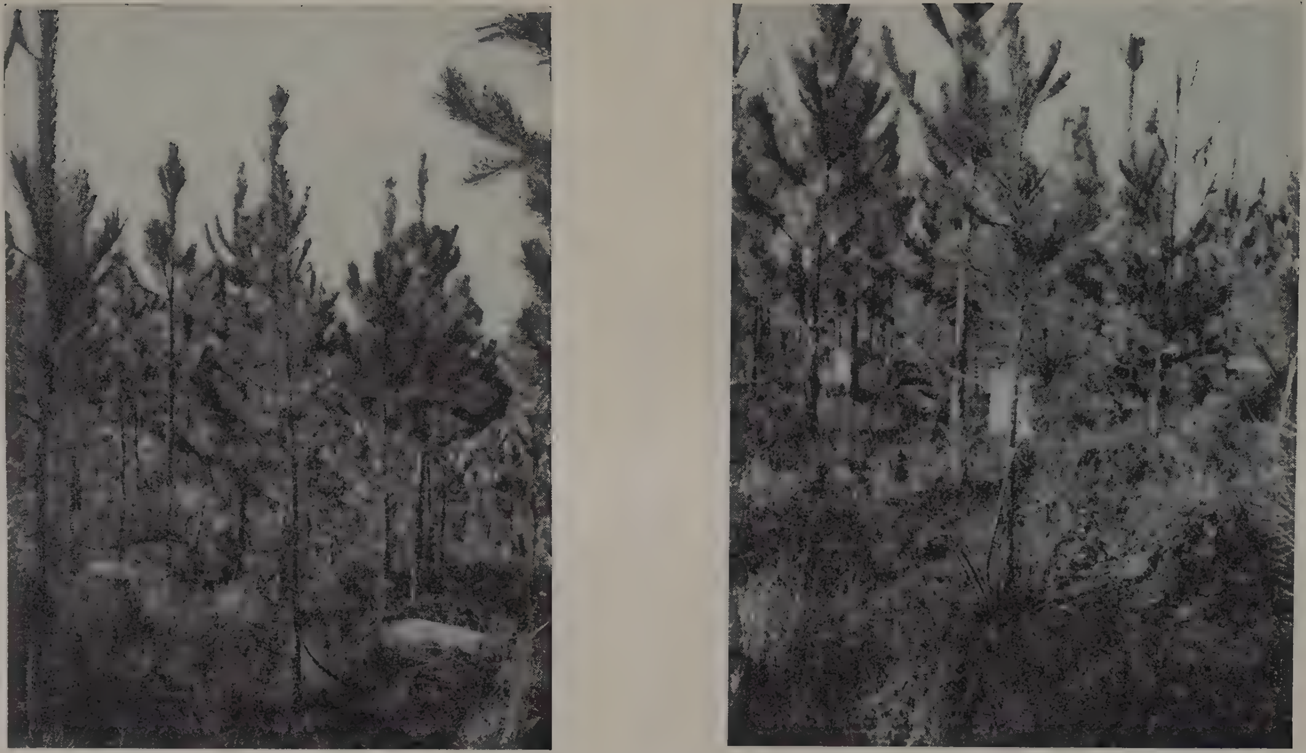

Plate 128.

The Effect of Carbohydrate Injections on Fused Needle Affected *Pinus caribæa.*—Left: Lævulose injection with no effect. Right: Saccharose injection causing recovery.

primary cause of fused needle disease and also for the carbohydrate theory regarding the significance of the mycorhizal relationship in relation to the tree.

The negative results obtained by Ludbrook (1938) from sugar injections may be attributed to the technique employed. In these experiments all the solution used was introduced at the one time over a period of two days. It is thought such a substance as a sugar would have little effect under these circumstances, as the present experiments have shown that the response is one which only occurs during the period of treatment. Besides this, sugar is such a readily utilizable substance, and any excess supply, such as would be introduced by the bulk treatment method, would be speedily converted by the plant. The provision of a continuous supply of carbohydrate, even if small, over a long period would be the only method of testing such a deficiency, since by this means alone could it be ensured that the carbohydrate as such was being made available to the plant involved over any long time interval.

It has been shown by Constantin and Magrou, in connexion with carbohydrate storage, that tuber formation in potatoes and in certain other plants is a response to fungus infection. Potatoes grown from seed when of a wild strain do not produce tubers in the absence of infection by the mycorhizal symbiont of the potato, which is the fungus *Rhizoctonia solani* (Magrou, 1914, 1921, 1924; *cf*. Kelley, 1937). Many improved strains, however, have developed the habit of forming tubers under cultivated conditions without the presence of the fungal endophyte. It has been shown that on the introduction of the potato to Europe from South America, only seed was at first used. The plants resulting from the sowing of the seed failed to produce potatoes. Later, however, tubers were introduced, and thus the soil became infected with the requisite fungus and tuber formation was successfully achieved. It has also been found that the placing of potato or tomato stems in cane sugar is followed by the production of tubers on these stems.

From the work of Constantin and Magrou it appears that, in the potato and certain other tuberous perennial plants, the effect of mycorhizal development is the production of reserve carbohydrate which is stored in the tubers. Other workers have made similar observations, and it has been stated that tuber formation is, in a number of species investigated, a response to fungus infection. These facts support the carbohydrate hypothesis of the significance of mycorhiza.

The investigations being carried out in connexion with starch elimination in timber in order to reduce the susceptibility of the timber to *Lyctus* borer injury is additional evidence. The theory underlying these experiments is that by girdling the trees just below the first branch so that the main trunk has the food supplies which are obtained from the leaves interrupted, the deposition of starch in the trunk will be stopped. It was hoped that the starch reserves of the trunk would gradually become depleted by the using-up of the carbohydrate stores in the process of cell metabolism. The practically starch-free timber would then not be susceptible to borer attack. In actual practice, however, ringbarking experiments with the oak tree (*Quercus robur*) in England have shown that the starch content of ringbarked trunks has remained unexpectedly high (Parkin, 1938). It is significant here to note that Acton in 1889 demonstrated the absorption of sugar by the roots of *Quercus robur*. The supplementary starch supply to the trunks which is evident after ringing has probably originated in the mycorhizas of the tree concerned, which is known to be mycotrophic. By this means it is seen that the carbohydrate would be supplied both by leaves and roots, and that on elimination of the leaf supply by ringbarking the roots would be able to provide sufficient for the needs of the trunk for some time. The system of double ringbarking as used by Parkin (1938) in his first experiment, where one girdle was cut at the base of the trunk and one at the top, should have no effect on the supply obtained from the roots, since the sugars would travel up through the xylem with the sapstream. Parkin's results so far support this contention.

(b) Pruning Experiment.

When the mycorhizal theory of the cause of fused needle disease was first postulated in 1934 it was thought that one of the means of investigating the supposed inefficiency of the root systems of diseased trees would be to remove by pruning a considerable portion of the crown and thus alter the root-crown balance. It was thought that by this means the insufficiency of any substance supplied either directly or indirectly by the roots would be offset by the removal of part of the crown, and that there would then be a tendency towards a restoration of balance which would be manifested by the subsequent healthy growth of the foliage.

In order that this aspect of the investigations might be examined, a block at Beerwah of thirteen rows containing a total of 150 five-year-old *Pinus tœda* trees planted in 1929 was marked out for pruning treatment. The trees averaged approximately 7 feet in height and showed a high proportion of fused needle disease and thin crown. They were growing on the site which carried the greatest amount of the disease in the plantation area. All the branches of the trees were pruned cleanly from the main stems up to the second whorl from the terminal bud. The effect of this treatment on the health of the trees is shown in Table XXX. The pruning was carried out on 21st June, 1934. A number of trees were left unpruned throughout the plot in order to provide a comparison.

TABLE XXX.

THE EFFECT OF PRUNING ON FUSED NEEDLE DISEASE.

Date.	Percentage of Pruned Trees Affected.	Percentage of Unpruned Trees Affected.
21–6–34	50·0	48·8
3–1–35	33·5	46·3
6–6–35	22·4	53·5
4–2–36	35·0	52·0
3–7–36	33·0	56·0
9–2–37	44·8	56·2

It will be noted that there was an immediate response to the pruning in that the percentage of needle fusion in the pruned trees immediately exhibited a decrease. This reduction in the number of trees affected continued for twelve months, after which there was again an upward trend towards the initial amount of infection. This upward trend synchronized with the regrowth of the crowns.

The experiment showed that there was a connexion between fused needle disease and root-crown balance. That is, it appeared that there was some factor connected with the root system which in fused needle areas was supplied in insufficient quantities to satisfy adequately the normal crown needs, but which, on the occasion of radical crown reduction by pruning, was sufficient. On the recovery of the crown, however, this again became inadequate, due to the consequent tendency to the upset of the balance again.

If it is assumed as a result of the sugar injection experiments that a carbohydrate supply is deficient in fused needle areas, then the pruning is an additional argument in favour of the theory of carbohydrate intake by the roots, since a reduction in leaf area would immediately reduce the crown to such an extent that the supply from the deficient mycorhizal system would be sufficient for the plant's needs, even though part of the photosynthetic system was removed.

(c) The Effect of Different Species of Mycorhiza-forming Fungi.

In another series of experiments carried out at Beerwah (Young, 1940) it was shown that different mycorhiza-forming fungi have different effects on the growth of *Pinus caribæa*. Considering it possible that the disease might be due to the presence of an unsuitable fungus symbiont, experiments were designed to obtain some information on this matter. Large boxes were constructed at Beerwah and placed on a rack above the ground and filled with nursery soil. The boxes and soil were sterilized with formalin. After sterilization the containers were sown with sterilized seed of *Pinus caribæa*. Each container, except that reserved for a control, was inoculated with a pure culture of a different mycorhizal fungus. The cultures were prepared on sterilized unhusked oats, and the resulting inoculum introduced to the boxes in drills alongside the seed drills when the seed had germinated. The fungi used were: *Boletus granulatus, B. elegans, B. bovinus, B. scaber, B. viscidus, B. luteus,* and *Russula* sp. The control box was inoculated with mycorhizas obtained from beneath a healthy stand of *Pinus caribæa*. These mycorhizas contained *Boletus granulatus* and *Rhizopogon roseolus*. After germination the number of seedlings in each box was adjusted by removing the excess plants so that an even number remained in each box.

At the end of the first growing season ten months later, when the plants were dormant and ready for planting in the field, all the seedlings were measured for height and every tenth plant sampled and the mean dry weight for each treatment determined. The measurements showed that the different fungi had different effects on the seedling growth. *Boletus viscidus* gave the best growth and was significantly superior to *B. elegans*, *Russula* sp. and *B. granulatus*. The actual results obtained are shown in Table XXXI.

TABLE XXXI.

THE MEAN HEIGHTS AND WEIGHTS OF *Pinus caribæa* SEEDLINGS INOCULATED WITH DIFFERENT MYCORHIZAL FUNGI.

Species of Fungus.	Number of Seedlings.	Mean Height in Inches.	Standard Error.	Mean Weight in Grammes.
Boletus viscidus	202	15·23	0·17	14·63
Boletus scaber	213	14·99	0·17	12·95
Boletus luteus	202	14·84	0·16	11·21
Boletus bovinus	200	14·82	0·16	14·19
Boletus elegans	223	14·55	0·15	10·79
Russula sp.	228	13·51	0·14	9·78
Boletus granulatus	190	13·21	0·15	12·92
Control (*B. granulatus-Rhizopogon roseolus*)	194	13·07	0·15	9·31

The results obtained indicate that different fungi have a definite bearing on the capacity of the one soil to support the growth of *Pinus caribæa.* It is possible that the fungi which produced the best growth were better able to use the available nutrients than the others, and from this point of view would be more desirable symbionts for the pine trees under the conditions of a poor soil. This factor could be turned to practical advantage by inoculating nursery soils with the most desirable fungus. It is noteworthy that the naturally occurring mycorhizal complex on the pine trees at Beerwah gave the poorest results.

In culture on ordinary media *Boletus viscidus* has proved to be the most vigorous growing species of those enumerated, and this capacity for vigorous growth may be the reason for the superiority of this fungus.

This fungus also proved to be the best for biologically indicating phosphate deficiency in soils, as was described earlier.

(d) Summer Fluctuation in Percentage of Fused Needle Disease.

It has been previously noted that there is a fluctuation in the percentage of fused needle disease during any one summer. Under normal conditions the number of trees affected in any one area tends to decrease in the first half of the summer from that recorded during the previous dormant winter period. After midsummer, however, there is a return to the fused condition of the majority of the trees which had improved. Also in plantations in the actively susceptible stage there is a further increase in percentage infection, accounted for by the number of previously healthy trees which then become diseased. In the light of the organic matter hypothesis in connection with the disease it is considered that this fluctuation can be directly correlated with the raw organic matter supplies.

During the winter months there is a considerable amount of leaf-casting carried out by the indigenous vegetation in the pine plantations as well as by the pine trees themselves. Owing to the cooler and normally drier weather this dropped foliage accumulates to a much greater extent than during the period in the moister and hotter summer months when oxidation and decay go on more actively. In the latter portion of the summer there is less leaf fall and the winter accumulation of plant detritus becomes exhausted under open conditions such as exist in a young pine plantation where the soil surface is relatively unprotected from the sun. In this way there are more suitable conditions present for healthy mycorhizal development in the first half of the summer than in the latter half. This means that the pine trees will be better supplied with nutrients, inorganic and organic, during the first half of the growing season than in the second half, and this is reflected in the appearance of the trees as described above. The phosphorus contained in the litter will, of course, after liberation, be fixed in the soil, but the concentration of this element in the soil will be much less and therefore less effective than when it was combined in the relatively smaller amount of litter.

When the pine stand has reached the closed stage, however, there is a greater accumulation of litter due both to the protective action of shading and also to the greater quantity of plant detritus thrown down. This factor results in the gradual elimination of the fused needle condition, for, instead of an increase in the percentage of diseased trees during late summer, there is a tendency for the early summer decrease to continue until ultimately a healthy stand results.

The Relationship between Phosphate Status and the Carbohydrate Hypothesis.

The stimulation effected by phosphorus applications, which has previously been described, can be attributed to four possible reactions. In the first place phosphate treatment causes an increased growth of the natural vegetation and a consequent increase in the amount of litter supplied to the ground surface. The importance of this action is evident when the delayed response of the pine trees to phosphate additions is considered. It is thought that the delay is due to the time which must elapse before the natural vegetation, as a result of increased vigour due to the manuring, has grown to such a stage that it produces the increased litter supply which is thus built up on the ground. The pine trees then are able, by means of their mycorhizas, to avail themselves of this extra food supply, which contains the necessary carbohydrate and phosphatic substances. According to this hypothesis the action of the phosphorus is of an indirect nature. The truth of this view is supported by results obtained from pot experiments. In this case a number of plants of *Pinus tæda* and *P. caribæa* (twenty of each) were grown in humus deficient soils, and after a period of two years had developed the typical symptoms of malnutrition, including chlorosis, thin crown, and fused needle. A phosphatic fertilizer was applied to the plants in the form of superphosphate at the rate of one-sixth of an ounce to each eight-inch pot. The plants in the pots gave no response to the treatment. The experiment was repeated in soil similarly deficient in organic matter but with plants produced from seed obtained from diseased *P. tæda* trees with similar results. If the phosphate effect was a direct one a response would be expected. The absence of suitable organic matter was apparently the reason for this negative effect.

The response which was shown by the clean-chipped plots which were treated with superphosphate, as is described in part "A" of this paper, may be explained by the increased availability of the residual organic matter in the soil due to the action of micro-organisms. It has been shown (Sing Chen Chang 1939) that the addition of phosphorus compounds to vegetable débris markedly increases the decomposition of the latter. In this way, on the phosphate-treated plots there was made available a greater amount of organic material for the stimulation of fungus and tree development. The residual supplies of the soil organic matter, owing to the absence of replenishment on these plots, must, however, ultimately reach a point of unavailability again. There is an indication at present that this is becoming the case, as is evidenced in the graph (Plate 85) showing the progress of fused needle disease in block K. Here, at the last observation period, an increase of the condition in these phosphate-treated plots was recorded (see also footnote, page 311). Analyses for humus bore out this hypothesis, as is shown in Table XXXII. The phosphate was added in 1937.

TABLE XXXII.

THE AMOUNT OF HUMUS IN CLEAN CHIPPED PLOTS WITH AND WITHOUT PHOSPHATE ADDITIONS IN BLOCK K (1939).

Treatment.	Mean Percentage Humus.	Number of Plots.
Clean chipped, without phosphate	1·61	5
Clean chipped, with phosphate	1·40	5
Control (unchipped, with natural ground cover)	1·84	5
Sig. Diff.	0·69	..

It will be noted that the phosphate-treated soil has, in comparison with the other clean-chipped soil, lost a considerable amount of its humus. The difference is not statistically significant but is constant from plot to plot. The amount of humus contained in the untreated soil is greater than in either of the clean-chipped treatments, and illustrates the deleterious effects of clean-chipping on soils of this nature.

The second factor concerned in the stimulation received after the application of superphosphate is in connection with the production of phosphatides by the higher plant. It has been shown conclusively by Melin (1925) that the phosphatides which are excreted by all parts of living plants are essential to the normal metabolism of the mycorhiza-forming fungi. The phosphatides appear to act not as direct nutrients to the fungi but as catalysts in metabolic processes and are not themselves sources of nutrient. Melin carried out a considerable number of experiments with various species of mycorhiza-forming fungi, and without exception all the fungi showed very large growth responses in the presence of these substances. He showed experimentally that enzyme formation in the fungi was promoted by phosphatides. For the successful functioning of the fungi as a means of nutrient absorption for the tree it would appear that the tree must first be able to supply the fungus with suitable quantities of phosphatide. In order to do this there must be present in the soil enough phosphorus for the manufacture of phosphatide in the tree. In this way the addition of phosphorus may indirectly promote the activity of the mycorhiza-forming fungi. The fact that the fungi need the phosphatide for the formation of enzymes is of considerable significance when the breakdown of cellulose to simple carbohydrates by the action of the mycorhizal fungi is considered. By excreting phosphatides the tree enables the fungus to supply it with carbohydrate.

The phosphorus applications may also cause a third reaction. This is a direct effect on the mycorhizal fungi. It is well known that this mineral is above all others essential for fungus growth. In fact, the elements considered essential for the higher plant are, with the exception of phosphorus, thought to be of minor importance in fungus nutrition. This characteristic of the fungi has been availed of for the formulation of biological tests for the availability of phosphorus in soil (Mehlich, Fred and Truog 1938). In devising this method the authors demonstrated that the addition of any of the essential elements other than phosphorus in reasonable quantities had no influence on fungus growth. They were able to correlate the growth of *Cunninghamella* spp. when grown on soil plaques with the amount of phosphate present in the soil.

In an experiment carried out by the author, soil samples in which the amount of total phosphate present was determined were obtained from the plots concerned in the fertilizer trials at Beerwah. The samples were placed in petri dishes and moistened with distilled water. Each sample was then inoculated with a piece of culture medium from an actively growing culture of *Boletus viscidus,* which is a known mycorhiza-forming fungus (Melin, 1925), and which has proved to be superior to all the other species experimented with in promoting the growth of seedlings of *Pinus caribæa* (Young, 1940). In the case of all the plots which were treated with phosphate the fungus grew rapidly through the sample, and covered the soil with hyphæ in forty-eight hours. In the case of untreated and phosphorus-deficient soils no growth was apparent. The only differences in the soils was the amount of total P_2O_5 present, which was determined by analysis previous to inoculation.

This experiment serves to stress the importance of phosphorus in the metabolism of a typical mycorhiza-forming fungus. With the presence of adequate phosphorus for fungus growth and the availability of a phosphatide supply, the fungus is enabled to carry out the breakdown of raw organic matter and transfer the products to the higher plant.

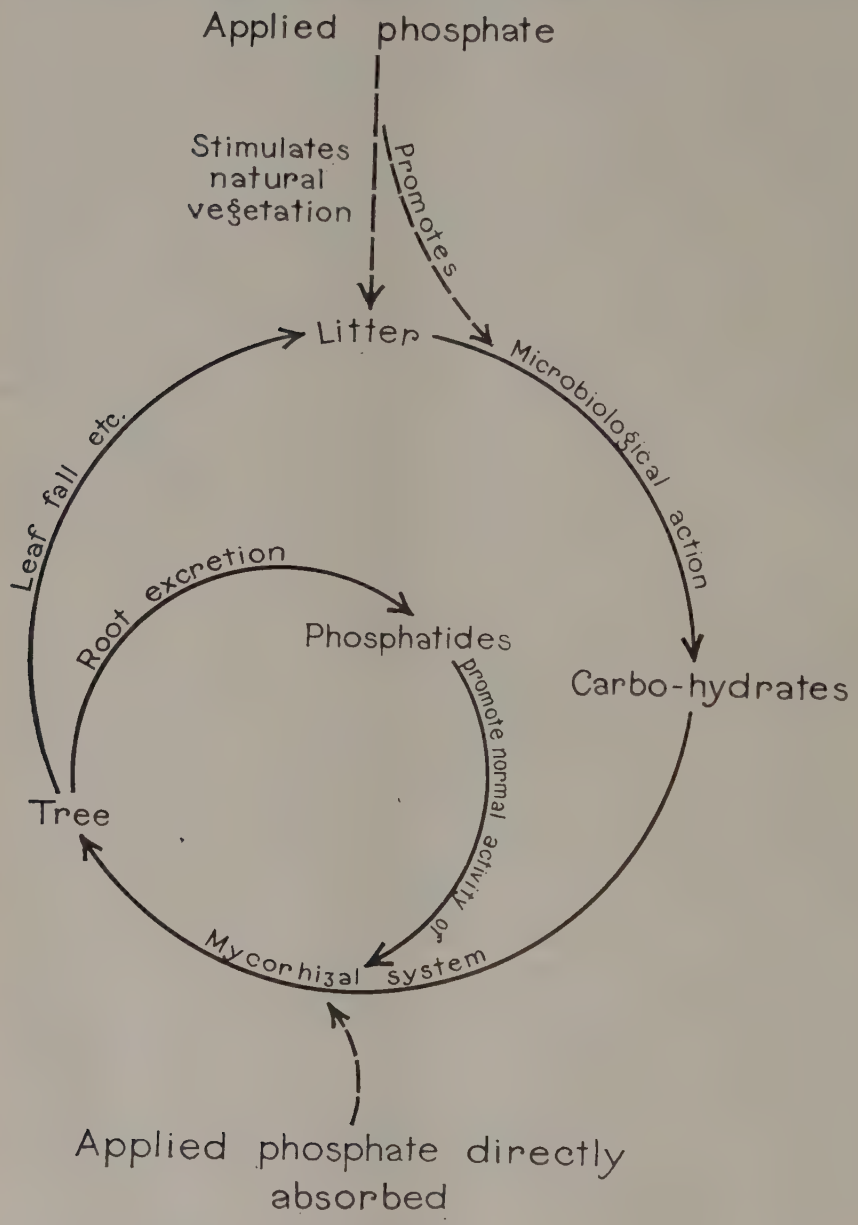
Applied phosphate
Stimulates natural vegetation
Promotes
Litter
Microbiological action
Carbo-hydrates
Leaf fall etc.
Root excretion
Phosphatides
promote normal activity of
Tree
Mycorhizal system
Applied phosphate directly absorbed

Plate 129.

DIAGRAMMATIC REPRESENTATION OF THE EFFECT OF PHOSPHATE APPLICATIONS ON THE NUTRITIONAL CYCLE OF THE PINE TREE.

The fourth aspect of phosphorus stimulation on the pine tree is the direct manurial effect. This, however, from the results obtained from the pot experiments, appears to be of little significance. The fact that the quantities of other nutrients present in the poor plantation soils where malnutrition occurs are also extremely low indicates that the application of any one of these deficient elements alone could not be the direct cause of vigorous growth. This aspect of the question has also been noted by Perry (1939) in Western Australia. In pot experiments carried out at Beerwah the application of an N.P.K. fertilizer, in the absence of organic matter, to plants suffering from malnutrition had no effect. It has been shown (Miller, 1931) that phosphorus in the plant plays an essential part in the translocation of carbohydrate. If, however, the carbohydrate supply is deficient, as is thought to be the case in soils deficient in organic matter, the phosphorus would not in this case be able to carry out its functions.

The effect of phosphate applications on the nutritional cycle of the mycorhizal fungus and the pine tree is illustrated diagrammatically in Plate 129.

In drier localities, such as at Pechey, on the brow of the Great Dividing Range, fused needle disease occurs on a soil with relatively high phosphate values averaging over 2,000 p.p.m. That the pine trees are able to absorb this phosphate is shown by needle analyses, which show a mean content in young green needles of *Pinus radiata* of 2,400 p.p.m. of phosphate in both diseased and healthy trees, with similar figures for *P. tæda* and *P. coulteri.* In this locality, however, the rainfall is limited to 30 inches per annum. There is, therefore, during the greater part of the year a deficiency in soil moisture as compared with the coastal soils, and a consequent poor development of leaf mould on the soil surface. The leaves falling to the ground do not rot in the usual way, but crumble to dust. This leads to a poor development of the moist organic horizon, so important in the nutrition of *Pinus,* and a consequent deficiency in health. In this occurrence of fused needle, the disease, although the same, is seen to be primarily due to a moisture rather than a phosphate deficiency. However, the primary cause is the same—that is, there is a deficiency in suitable organic matter brought about in each case by the respective factors just mentioned, which results in a badly balanced mycorhizal association. The treatment of the condition occurring at Pechey is much more difficult than in the case of a simple phosphate deficiency. It would consist in the conservation of a greater amount of moisture in the surface soil than is normal in the young plantations, and this, under present conditions, is not economically possible. This effect, however, is brought about naturally as the plantation develops. The ground surface then becomes sheltered from the hot drying sun and winds, and a favourable type of litter is then formed. The beneficial effect of this is evidenced by the increasing vigour of the trees after crown closure and the increase in moisture in the soil surface.

There is evidence that the depressing effect of ammonium sulphate is also due to a reaction on the mycorhizal fungus rather than the tree itself. This was further investigated by means of a somewhat similar type of experiment to that carried out to demonstrate the effect of varying quantities of soil phosphate on the growth of a mycorhizal fungus. Pure cultures of *Rhizopogon roseolus, Boletus granulatus,* and *Boletus viscidus* were used as indicators. All three of these organisms are proved mycorhiza formers of *Pinus tæda* and *P. caribœa* (Young, 1937). The fungi were grown on plates in petri dishes at 26 deg. C. The medium was Coon's synthetic medium, but the formula was varied so that four media were prepared differing only in the source of nitrogen, which was supplied as equivalent quantities of asparagin, sodium nitrate, ammonium sulphate, and sodium nitrite. The rate of growth of the three fungi on the different media was measured by the radius of spread over the surface of the plates in the same time. The results obtained from this experiment are shown in Table XXXIII., and represent the mean results obtained from ten cultures of each fungus on each medium.

TABLE XXXIII.

THE EFFECT OF DIFFERENT NITROGEN SOURCES ON THE GROWTH OF THREE MYCORHIZAL FUNGI.

Nitrogen Source.	Radial Growth in Millimetres.		
	R. roseolus.	*B. granulatus.*	*B. viscidus.*
Asparagin	Nil	9·5	40·0
Sodium nitrate	3	16·0	52·0
Ammonium sulphate	Nil	4·0	15·0
Sodium nitrite	Nil	11·5	40·0

It will be noted that *Rhizopogon roseolus* showed very little growth on any of the media used. This fungus is a difficult one to culture on ordinary media. Good results, however, were obtained with both *Boletus granulatus* and *B. viscidus,* the latter fungus in particular being a very vigorously growing type. The best growth was obtained on the sodium nitrate medium. The asparagin and sodium nitrite media produced approximately similar results, and the ammonium sulphate gave significantly bad results.

From this it will be seen that there is an evident correlation between the depressed growth on the ammonium sulphate-treated plots of pine trees and the retarding effect of this substance on the activity of the mycorhizal fungi. The increase in fused needle disease on these plots was also very noticeable. See Tables XXI. and XXII. and Plates 95, 96, and 97 in Part A of this paper.

The stimulation of the production of chlorophyll, and hence extra carbohydrate, by the use of certain minor elements, notably zinc, as described in Sovietski Sub-tropiki (1938) would effectively explain the results obtained in Western Australia by the treatment of pine trees with these elements and accords well with the present hypothesis.

(VI.) GENERAL CONCLUSION.

The present paper seeks to show that the cause of fused needle disease and the related manifestations of malnutrition which occur on the poorer forest soils is intimately bound up with the mycorhizal complex. The deficiency of raw organic matter brought about by the clearing and burning of the natural forest, followed by general forest management methods, tends to produce a maximum effect on the trees from the fourth to the sixth year of normal plantation growth. In some cases this maximum is retained for a long period and is liable to result in plantation failure. The deficiency in the raw litter causes development of an unhealthy mycorhizal condition, which results directly in the malnutrition of the tree. In poor soils, owing to the low concentrations of plant nutrients, the large absorptive surface provided by a well-developed active mycorhizal system is essential for a balanced tree nutrition. In addition, the provision of a carbohydrate supply by the root complexes of the trees in question seems to be intimately bound up with the health of the trees, and for this purpose the presence of an available and continuous supply of raw organic matter, from which the hymenomycetous fungi concerned in mycorhiza formation can produce this carbohydrate, is essential. From injection experiments it is indicated that the carbohydrate supplied is in the form of a sugar.

The application of phosphatic fertilizers to poor plantation soils capable of retaining phosphorus results in the healthy growth of *Pinus tæda* and *Pinus caribæa* which have been affected by fused needle and other symptoms of malnutrition. The effect of phosphorus is mainly an indirect one and is considered to be due to four reactions: (*a*) the resulting increase in litter due to the stimulation of the natural vegetation; (*b*) the stimulation of fungus growth which thus makes more organic food supplies available; (*c*) the stimulation of the phosphatide excretion of the roots of the pine tree, which results in better mycorhizal development; (*d*) the direct nutrient effect on the pine tree. The last effect is thought to be relatively unimportant. The litter obtained from the increased ground cover favours the desired mycorhizal development and provides a source of carbohydrates as well as phosphates and other substances. The ground cover protects the feeding roots of the trees to some extent from heat effects.

The provision of a higher proportion of phosphorus than is normally present in the plantation soil at Beerwah before litter formation has begun seems essential for the satisfactory growth and fructification of *Boletus granulatus* and *Rhizopogon roseolus*. The favourable growth reaction is probably due to a direct nutritional effect and to the stimulation of phosphatide excretion of the higher plant. It is possible that this is not wholly a direct effect, but is due to the result of a change in the biological direction of the humus breakdown in the soil. The phosphate dressings bring about a healthy condition of the mycorhizal relationship so that, in areas which were formerly diseased and carried trees which possessed a large proportion of abnormal mycorhizas, the nature of the root fungus relationship becomes more favourable. Before treatment the fungi exhibit a parasitic tendency and actively attack the cells of the root cortex. After treatment the fungus becomes non-parasitic and is able to be digested by the root cells. This conception taken of the significance of the mycorhiza is an extension of that adopted by Frank and elaborated by Melin, Stahl, Rayner, and Hatch.

It is thought that as well as providing a more efficient absorptive system on the tree roots so that mineral salts and nitrogen compounds are more readily available, the mycorhizas also furnish a means of augmenting the carbohydrate supply. In this connexion it is pointed out that the fungi concerned are known saprophytes, and the roots of the higher plants are known to be efficient organs for salt absorption. If this is accepted the view usually taken of the root fungus association in which the fungus is thought to obtain carbohydrate from the higher plant and the higher plant to receive mineral salts from the fungus is one which postulates an evolution in direct opposition to the normal physiological forces operating. In the author's conception the fungus manufactures its own carbohydrate supply from the available soil organic matter, and a portion of this is transferred to the higher plant by means of the intimate association existing in the mycorhizal structures. Nitrogenous compounds probably come within this category, though in the case of the pine there is no evidence that they are a limiting factor. Mineral salts are also obtained per medium of the fungus hyphae. It is thought in this case that elaboration on the part of the fungus is not of such a complicated nature. It is difficult to understand how the fungus can obtain comparable benefit from the symbiotic relationship, other than its dependence on the plant host for an essential supply of phosphatide or other phosphorus compounds. In this way one can obtain a satisfactory explanation and also an understanding of how the evolution of the root fungus partnership originated.

In normal plantation practice, except in dry areas, it is considered that a convenient indicator of what sites are liable to be affected by any of the troubles discussed, other than the using of the pine trees themselves for this purpose, would be the results of analyses for total phosphate. Consideration has been given to this matter and work at present being carried on indicates that for *Pinus tæda* the limiting figure is close to one hundred and thirty-five parts per million. *Pinus caribœa* demands a minimum total phosphate value of 110 p.p.m. However, whenever indications of the troubles discussed are found the condition is readily and economically remedied by applying a broadcast dressing of calcium superphosphate. In the case of soils with a low phosphate fixing capacity the dressing should consist of ground rock phosphate. Under normal conditions the cost of labour and materials for a three-hundred weight dressing of superphosphate does not exceed 17s. per acre.

In dry areas with fertile soils, fused needle disease appears to be due to a moisture deficiency which results in the deficiency of a litter formation suitable for mycorhizal activity.

Applications of nitrogen, calcium, potassium, zinc, and other elements have had negligible effects in reducing the incidence of the disease. Ammonium sulphate, in fact, actually causes an accentuation of the condition when applied alone. When used in combination with other fertilizers it depresses their beneficial effects.

In the light of the foregoing hypothesis the sequence of events in fused needle affected areas on poor coastal soils may be summarized as follows:—The preparation of a plantation site under normal conditions involves the removal of marketable timber and the cutting-down of the remainder of the naturally occurring forest trees, followed, after the lapse of a suitable period to allow for the drying-out of the felled trees, by the burning of the area. The burn results in the destruction of all effective surface organic matter and the liberation of the contained inorganic salts. At the time of planting on the poor soils usually used for plantations of *Pinus* spp. in Australia there are few weeds or coppice growths yet present in quantity sufficient to provide any appreciable litter formation. The inorganic salts contained in the original litter, including the phosphates, are then washed into the soil where the concentration is less than in the litter. During the first two years, however, there usually appears to be enough suitable organic matter left in the soil for the satisfactory nutrition of the pine trees. During the first twelve months after planting, the roots of the plants do not find their way to the surface from the planting holes, and the normal surface feeding system is not developed until towards the end of the second year. During this period the residual organic matter supplies, of the type necessary for pine nutrition under the local conditions, gradually becomes depleted owing to the action of the soil fauna and flora and oxidative processes, and the insufficient replenishment provided from above the soil surface. It is considered that the diseased condition is manifested when these organic matter supplies reach the minimum requisite for healthy growth, and that, when the ecological development of the plantation advances to forested conditions again, involving the adequate provision of organic matter with its included phosphorus compounds and healthy mycorhizal development, the disease eventually disappears. The direct surface application of phosphatic manures, at a comparatively small cost, stimulates plant and fungal growth and eliminates the necessity for this delay.

The emphasis placed upon certain aspects of the nutrition of the pine tree in the course of the investigations resulting in the above conclusions may have more far-reaching effects in that the hypothesis established may lead to a better understanding of plantation problems not directly included in the scope of the present work.

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FODDER CONSERVATION ON THE DOWNS.

Fodder conservation on a large scale is an extending practice on the Darling Downs, and results are proving beneficial to all concerned.

Around one centre, practically no silage was made a few years ago; and now more than fifty dairy farmers have pit silos filled with sorghum.

The cost of digging the pit, harvesting the crop, filling, and covering the pit ranges from three shillings to five shillings a ton of silage made.

One farmer in the Pittsworth district has now had six years' experience with this form of fodder conservation. He began with a stack, but abandoned it because of excessive waste. His estimated cost of digging the pit, harvesting the crop, and covering the pit works out at three shillings and sixpence a ton. The cost, of course, is reduced when the pit is used several times. He now has 400 tons of silage in four pits. Some of the pits have been filled four times, and silage down for three or four years has opened up in perfect order.

And this is how fodder conservation has worked out recently in actual practice—

> A dry spell was followed by a grasshopper invasion which destroyed young crops of Sudan grass, making it necessary to begin hand feeding the dairy herd with silage. About 2 tons of silage a day was fed to fifty cows, the only other feed being a green pick from grass.
>
> On the second day after starting to hand feed the silage to the dairy herd, the milk supply began to improve and very soon equalled the quantity given when the cows were grazing on green stuff.
>
> Two tons of silage a day would be worth seven to eight shillings, plus labour. On the credit side, the milk yield increased, and continued to increase, about three-quarters of a gallon per cow per day.

Some Agricultural Problems of the Mackay District.

By H. W. KERR.*

Introduction.

DURING the 1939 harvesting season the seven mills of the Mackay district contributed some 210,000 tons of sugar to the record Queensland production of 890,000 tons. It may therefore well justify its claim to distinction as the major sugar-producing area of the State. Moreover, a study of production figures over the past five years shows that the expansion in yields in this area has progressed at a more rapid rate than that for Queensland as a whole. One might therefore infer that the Mackay district standards of agriculture are progressing rapidly to a high level of production efficiency, in a manner comparable with that of other areas south of Townsville. If we should take out the average production per acre figures for Mackay and the rest of Queensland for the past twelve years we find—

Year.	Mackay. Tons per acre.	Rest of Queensland.
1928	13·2	18·2
1929	11·5	17·8
1930	12·2	16·6
1931	11·7	18·7
1932	12·1	18·7
1933	16.5	21.8
1934	14·7	21·2
1935	14.9	19.6
1936	17.4	22.5
1937	14·2	22·6
1938	16·4	23·0
1939	18·5†	23·2†
Average	**14.4**	**20.3**

†Estimated.

These data will doubtless come as a surprise to many farmers. Certainly they show that average cane yields per acre in Mackay have improved materially in recent seasons over what they were even ten years ago; but they are so markedly below those for other areas, that it would appear worthwhile pausing to enquire whether there is some insurmountable obstacle to the attainment of a more flattering figure.

To some growers it may seem that with the Bureau the "crop yield per acre" factor has become an obsession, to the exclusion of all other considerations. While not admitting the truth of such a charge, it will be confessed that we have been forced to regard the intensity of production as one of the most reliable yardsticks of comparative prosperity as between one area and another. The reason is to be found in the fact that, in a country which boasts a high standard of living comfort for its people, the relatively high rate of wages earned by its inhabitants demands a correspondingly high standard of production efficiency, if the real benefits of such a system are to be enjoyed. If we should analyse the cane production costs from farm by farm we would find, in general, that the largest single contributing factor is that of labour charges. We therefore recognise that any attempt to reduce costs must be closely associated with improved efficiency in the utilization of man power.

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* In an address to Q.S.S.C. Technologists at Mackay Conference, 1940, and reprinted from *The Cane Growers' Quarterly Bulletin* (Department of Agriculture and Stock) for April.

This may best be illustrated by a simple example: If the sum total of a farmer's efforts for a year be the production of a cane crop of 250 tons, and the value of his wages be placed at £250, the contribution of labour costs to the total production costs is £1 per ton of cane. Suppose that by the adoption of improved methods, the production per unit of labour could be increased to 500 tons of cane, the labour cost per ton is automatically reduced to 10s. It is generally safe to assume that the means employed for increasing efficiency of labour utilization would not absorb anything like the amount of saving in labour costs effected, and the net result is a decidedly improved financial position for the individual.

If we should seek appropriate means for bringing about this hypothetical advance in status, we should almost certainly not find that it could be effected by an expansion in the area cultivated. Though some temporary advantage might be gained if new land could be brought into production, this in itself would never be permanent. There is clearly a definite limit to the area which one man can effectively till, unaided, and we must seek the answer in improved tonnages of crop per acre. While one man may take care of a farm producing 600 tons of cane at an average yield of 40 tons per acre, it is certain he could not attempt to care for 50 acres each of which averaged but 12 tons of cane per acre.

It is appreciated that many growers in the Mackay district have assigned areas which could not permit of the farmer making a success of his business from cane growing alone; but that is a question which lies beyond the scope of this discussion. On the other hand, there are many farmers who cannot offer this as an excuse for the relatively low production efficiency they have been able to accomplish. It is the purpose of this address to discuss briefly the major factors responsible for the conditions indicated, and to suggest means whereby they may be overcome.

In the first place, it should not be inferred, from the example presented above, that we consider for one moment that much of the Mackay land is capable of a sustained production average of 40 tons of cane per acre. On the contrary, it is recognised that standards of efficiency are not rigid and can only be established after a careful assessment of all relevant factors: and, briefly, while an average production of 25 tons per acre would be regarded as a high accomplishment under one set of conditions, a level of 30 tons might in other circumstances be considered decidedly mediocre. This aspect of the question will not be overlooked in any comments which are now offered.

Mackay Cane Soils and Climate.

The lands of the Mackay district vary in quality from rather poor, shallow, inadequately-drained soils to the high quality silty alluvials which constitute the best of our Queensland cane lands. The major portion of the cultivated area consists, however, of a medium quality alluvial loam, of reasonable depth, but often of low water-holding capacity, and presenting substantial tillage difficulties due to the unfavourable condition of the moderate quantity of clay which they carry: in common with most canelands of Queensland which have been under cultivation for fifty years or more, the humus content of the land is at a low level.

What the quality and production capacity of such lands were in their virgin state we can only guess. Certainly they were cultivated for many years before the accumulating knowledge of the soil's requirements in respect to plantfoods, and the true value of artificial manures in the maintenance of fertility, were widely appreciated or applied. The present-day farmer on these older lands is therefore faced with a problem which does not enter into the calculations of the grower who is able to commence the business of cane growing on virgin land. This problem is thus one not of maintaining fertility, but of creating and building up the productive power of an impoverished soil.

As regards the rainfall which the district normally experiences, it must be conceded that it is no better than that of most cane areas south of Townsville. Though it exceeds in the aggregate the average annual precipitation of practically all other cane districts within these confines, the excessive downfalls of the wet season are frequently a disadvantage, following very often an unduly dry spring and early summer season which has seriously checked crop growth. This is notably true for the indifferently drained lands of the district.

Summed up, the Mackay farmer's problem is one of producing satisfactory crops on a soil very often deficient in plantfoods, and of which the moisture-retentive capacity does not permit of sustained crop growth during the protracted drought periods, which so frequently follow beneficial falls of rain. How are these defects to be overcome?

Discussion of Problem and Remedies.

It is a well-recognised agricultural principle that, other things being equal, a crop feeding on a fertile soil will utilize the available moisture in the land much more efficiently than one which is deficient in respect of one or more plantfoods. Increasing the humus or organic matter content of the soil will, as we have repeatedly stressed, improve both soil plantfood supply and moisture holding capacity. Judicious fallowing of the fields under grass cover also enables the land to recover something of its former fertility, because its plantfood reserves are being conserved and not removed from the farm in cane crops; this policy also leads to a general improvement in the physical condition and hence the tillage qualities of the land. But it will be found in practice that before such means can be invoked to an effective degree, the interminable drain on the already depleted plantfood supply of the soil must be stopped. The judicious use of the correct kinds of artificial manure alone can bring about an immediate and measurable improvement in the magnitude of the cane crops harvested. Without this, any plans for the conservation of any cane crop residues or even the growth of satisfactory grass or other fallow land crops cannot be adopted successfully. However, the farmer must not conclude that such a policy will inevitably necessitate the purchase of the high-priced mixtures which the fertilizer representative may urge. On the contrary, it will frequently be found that judicious buying will enable a marked improvement in crop yields to be effected at relatively low cost.

Firstly, the true nature of the plantfood deficiencies must be determined. The well-planned fertility trial offers most in this regard: but as everybody cannot be catered for in this respect, the next best thing is an analysis of the soil. This service is offered free to all cane-growers, and the Bureau officers will even sample the soil on request and attend to its despatch to our laboratories. The farmer will thus learn whether the phosphate or potash requirements of the soil are most acute, and plan his purchases of manures accordingly, as will be recommended. Phosphate is a relatively cheap material to buy, and more often than not it is the one most urgently needed. As regards nitrogen—the most expensive (per unit) of all fertilizer constituents—the Mackay grower may be assured that soil deficiencies in respect of this nutrient are probably the most important single fertility factor contributing to deflated cane tonnages. This is notably true with ratoons. Moreover, it is the one plantfood the supply of which can be effected, at least in part, through the efforts of the farmer himself.

Fallowing with Green Manuring.

We have on many occasions urged the value of green manuring with legumes as the soundest policy to be followed for the effective treatment of fallow cane lands. By virtue of the co-operative enterprise which pea and bean crops exhibit towards the interesting root-nodule organisms which exist in the soil, the crop is able to accumulate large amounts of nitrogen which represents a net gain to the soil when the crop is turned under and rotted. This nitrogen becomes readily available for the nutrition of the cane crop which is next planted in the field, and provided the leguminous crop has made successful growth it is almost certain that the full nitrogen requirements of a heavy cane crop will be met from this source.

Unfortunately, the ratoons which follow will derive little residual effects from this treatment a year later; and it will be necessary to apply at least a modest dressing of sulphate of ammonia, in addition to the appropriate mixture of phosphates and potash, to assure a satisfactory cane yield.

The better utilization of mill by-products is a matter which might well engage the attention of farmers favourably located in respect of the mill. Both muds and molasses can be employed to build up the plantfood reserves of the land, and these are generally much cheaper than the equivalent materials in the form of artificial manure. If the molasses is used as stockfeed on the farm the plantfoods which it contains are ultimately returned to the land.

The farmer who embarks on such a plan of soil fertility building, with limited means at his disposal for the purchase of even the bare essential needs of fertilizers, will usually discover that it is a good plan to throw in a year (or even more) of fallow in order that the process he has initiated will progress most speedily. This recommendation presupposes, of course, that the farmer has ample assigned land available to enable this to be done. We are, indeed, attempting to demonstrate the wisdom of such a scheme on one of the poorer blocks of the Mackay Experiment Station. Though it will be some years before the benefits can be adequately demonstrated, it is of interest to record that yields to date have been very satisfactory for both plant and first ratoon crops: and it is an essential feature of the plan that second ratoon crops of cane will not be grown for some years to come, despite the fact that first ratoon crops are of a standard which suggests that at least a third cutting would give a fair return. The object is, of course, not only to raise the fertility to a reasonable level, but to hold and improve upon this level as the rotation progresses.

The need for a satisfactory long-fallow leguminous crop is fully appreciated, and much effort is being devoted to the realisation of this ambition. Already a number of newly-introduced species have been tested, and one or two of these possess decided promise. Trials are being made at the present time in all areas with Gambia pea, while a ''first cousin'' which has a shrubby growth habit and is known as Giant Crotalaria is also of interest. A crop of the latter has been growing on the Bundaberg Station for the past 16 months, and has produced a very heavy growth. If such species could be utilized for grazing purposes, the land would still derive the major benefits from leguminous crops, and the necessity for frequent seeding during a long fallow would be avoided.

For short fallows, Poona pea still appears to possess greatest merit; one important feature in its favour is the low cost of seeding an acre. It is a good drought resister, but naturally thrives only when the soil moisture supply is adequate; on waterlogged land it is liable to be killed out by wilt, so that attention to land drainage will benefit both cane and green manure crops.

Plate 130.

ILLUSTRATING THE GROWTH HABIT OF GIANT CROTALARIA.—Crop on the left, 15 months old; on the right, ratoon crop 8 months old. The original growth of the latter half had been cut down in May, 1939.

Trash Conservation.

Trash conservation is generally frowned upon by Mackay growers. Almost without exception ratoon crops are burnt before harvesting, and where such crops are light, there would seem to be no alternative. But this is merely side-stepping the issue; we would repeat that the practice of trash conservation offers by far the best means available for restoring soil humus and fertility. Our trials to date at the Bundaberg Station confirm the wisdom of the policy, which has also been incorporated in the rotational trial field at Mackay which was discussed earlier.

Obviously the first essential is to bring the land to such a state of fertility that a first ratoon may be produced which can be harvested economically in the leaf. Again, moderate fertilizer treatments combined with long fallowing and green manuring would appear to offer most in this regard.

Soil Acidity and Drainage.

There are two further important factors which do not appear to have received the full attention which their importance demands, in any attempt to eliminate unfavourable growth factors from much of the Mackay area. The first is the use of lime, to correct harmful acidity which exists in many old soils. The Bureau officers can carry out a rapid soil test on the farm and inform the grower immediately if his land is in this condition, and this service should also be more fully availed of by farmers. The second factor is that of soil drainage. This subject has been fully discussed at past Conferences of the Society held in Mackay, and it is safe to state that as much potential cane growth is lost by waterlogging of land in the wet season as is forfeited due to dry weather in a normal spring. Admittedly the solution of the problem is not simple, and where large expanses of low level land exist, much ingenuity is called for in correcting such troubles. But it has been done effectively by certain well known growers of the district, and the improvement in crop growth which has followed has in some cases been extraordinary.

Irrigation.

To overcome losses from drought, the obvious direct remedy is irrigation. The resources of the area in this regard are doubtless inferior to those of the neighbouring Burdekin district; but again, all too little importance has frequently been attached to the desirability of the practice. Available water exists in the drifts underlying many farms of the area, while much of the water running to waste in the coastal streams could be put to good use if handled intelligently. It is sincerely hoped that closer attention will be paid to this important phase of cane production in the near future.

Cultivation Methods.

In a district where the rainfall distribution is erratic and uncertain, the value of timely cultivation cannot be over-estimated. Though it will be admitted that the land preparation for, and tillage of, the plant cane is reasonably good, ratoons are too often allowed to take their chance. Such a policy inevitably spells disaster, for a ratoon crop is no more able to get along without assistance than could plant cane. It would seem that this experience is, in many cases, a direct consequence of an attempt to make up by extensive cultivation what the farmer is not able to achieve on per acre production; but as was discussed the basis of such a policy is unsound and the farmer would be well advised to recast his plans, and seek to intensify production on an area which he can adequately manage.

Finally, one must stress once again what is doubtless in the minds of all Mackay growers—that the future of agriculture in the potentially rich Mackay district must lie in the ability of its farmers to develop their lands for the production of crops other than cane. Much has been written and stated regarding the possibilities of some form of stock raising, which would dove-tail admirably with cane production, on farms where land is available for the purpose. The question cannot be dealt with in detail at this juncture; but suffice it to say that it offers a means of deriving income from land while in fallow, and the net effect is to improve both the financial position of the farmer and the productivity of the land for cultivated crops.

Conclusion.

This presentation of certain Mackay problems has necessarily been sketchy in nature and incomplete in its treatment; but it is hoped that the points raised will serve to bring out some profitable discussion on this subject, which is certainly the most important one to Mackay growers generally. Though no attempt will be made to forecast the ultimate attainment of the district, in so far as cane production is concerned, it is safe to assert that an objective of 3 tons of sugar per acre as an average standard of production for the entire area is definitely modest. We feel that in the course of a few years the average production per acre on the Mackay Experiment Station will be 25 tons of cane, and it must be admitted that this farm is not above the average quality of the Mackay lands. The forecast result will be achieved by employing the methods which have been recommended above for Mackay growers generally.

QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

MAY.

Millmerran Rodeo	6th
Longreach	6th to 8th
Mundubbera	8th and 9th
Beaudesert Show	8th and 9th
Nanango	9th to 11th
Beaudesert Campdraft	10th and 11th
St. George Show	10th and 11th
Blackall	13th and 14th
Roma	14th to 16th
Gayndah	15th and 16th
Mitchell	15th and 16th
Murgon	16th to 18th
Warrill View	18th
Barcaldine Show	21st and 22nd
Ipswich	21st to 24th
Goomeri	23rd and 24th
Biggenden	23rd and 24th
Baralaba	23rd and 24th
Baralaba Rodeo	25th
Kalbar	25th
Charleville Show	28th to 30th
Gympie	30th and 31st and 1st June
Lowood	31st May and 1st June

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Nambour	11th and 13th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	29th to 31st
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th
Caboolture	26th and 27th
Atherton Show	30th and 31st
Crow's Nest	31st and 1st August
Maleny Show	abandoned for 1940

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Canungra	7th
Pomona	13th and 14th
Rocklea	14th
Malanda Show	18th and 19th
Beenleigh	20th and 21st
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

A Cane Hoist Operated by a Motor Cycle Engine.

By E. V. HUMPHRY.*

AS many farmers know, hauling up a load of cane by hand is not an easy job, and the winch is still worked by hand in most districts. Now that the motor lorry is used for carting, everything has been speeded up, and the transfer of cane to railway wagons also deserves attention.

Two farmers in the Giru district decided to arrange some form of power to operate the winch, and they did so, using an old motor cycle engine as the source of the power. The outfit was fitted up quite successfully on the farm with a little assistance from the mill workshop.

The essential features of the engine are illustrated in Plates 131, 132, 133: the unit has been in use for a number of seasons, proving most economical and a very valuable time and labour saver. The whole process of lifting the load from the wagon or lorry and crossing it to the cane truck is done by one man (the carter) in a few minutes. Before the engine was mounted, at least two men were required and the time taken to haul up the load was about four-fold that taken by the engine. The petrol consumption amounts to about one bottle to every 35 tons, which, in the circumstances, is negligible. It is designed to operate a 5-ton winch and has lifted to within a few hundredweight of that amount.

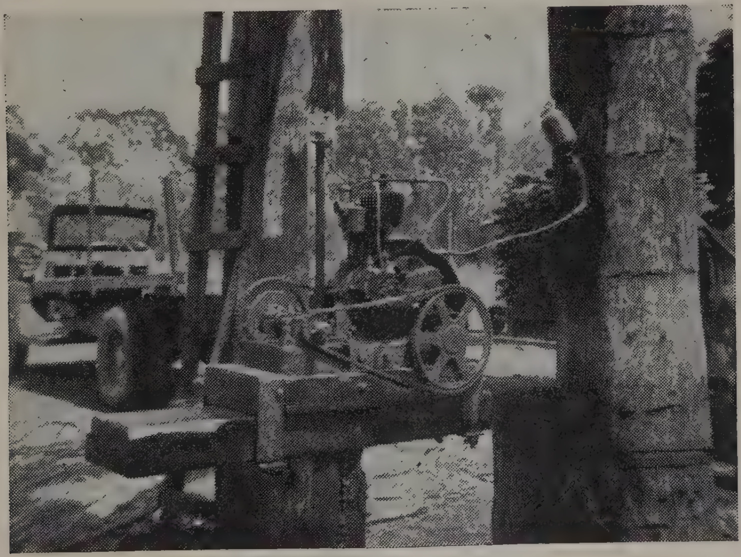

Plate 131.
CLOSE-UP VIEW OF MOTOR CYCLE ENGINE ADAPTED FOR USE IN CANE HOISTING.

The following paragraphs, studied in conjunction with the photographs of the outfit and an elevation and plan drawing, should give a fairly detailed and clear picture of the manner in which this simple outfit can be constructed.

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* In *The Cane Growers' Quarterly Bulletin* (Department of Agriculture and Stock) for April, 1940.

The engine is a single cylinder A.J.S. motor cycle engine stripped from the frame, together with pinion and chain and chain wheel. It is mounted inside two pieces of timber (A1 and A2), 11 in. x 3 in. x 3 in. These pieces are bolted to the main frame timber (B), which is 32 in. x 9 in. x 4 in.

A drive is taken from the crankshaft chain pinion (C) to a 1¼ in. shaft (D), 12 in. long, carried in two brassed-lined plummer blocks (E) raised on 3 in. timber (F). This drive consists of the pinions, sprocket wheel, and chain taken from the motor cycle. The chain wheel (G) is at one end of this 1¼ in. shaft, while the other end is turned down to 1 in. diameter and carries the pinion (H) of the second chain drive.

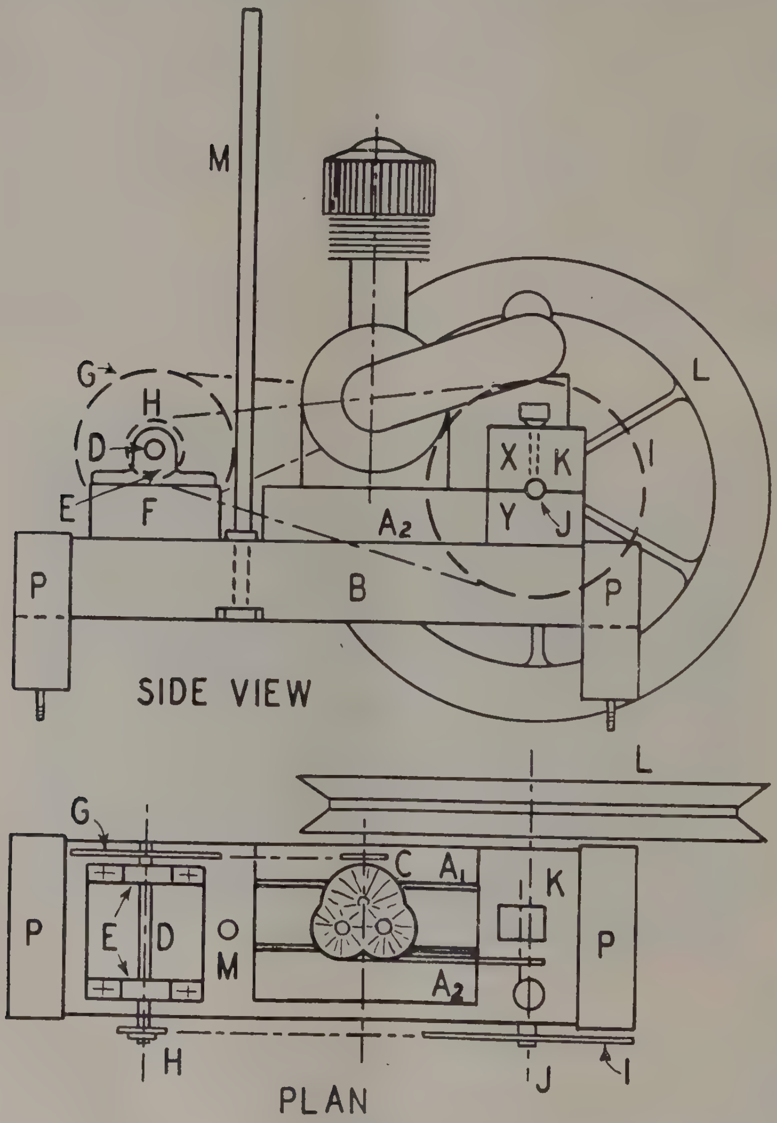

Plate 132.

PLAN AND SIDE VIEW OF THE ARRANGEMENT USED.—*See* text for explanatory notes.

This second chain drive is a Renold chain reduction with the 19-tooth pinion (H) driving a 76-tooth wheel (I) by a ½-inch pitch chain. The 76-tooth wheel is mounted on one end of a 1½-inch diameter shaft (J), 15 in. long. Actually, this shaft is carried in a long wooden bearing (K) formed by boring out pieces of timber 5 in. wide by 3 in. deep, two pieces (X and Y) being bolted together and carrying the shaft midway between them. Two grease cups are provided for the lubrication of the bearing.

At the other end of the shaft is mounted a V-groove chain pulley (L), 24 in. outside diameter. This chain pulley takes the ordinary endless hand chain of the winch and drives the large V-groove chain wheel on the winch. A piece of ¾-in. diameter pipe (M) is mounted vertically on the base timbers, being secured with lock nuts on either side of the timbers. This pipe serves to carry the throttle controls. The petrol container is hung from a nearby post (*see* illustration) and connected to the carburettor by means of copper and some flexible metallic piping.

Plate 133.

CANE LOAD WHICH HAD JUST BEEN LIFTED BY THE SMALL ENGINE.

The base timbers have U-shaped pieces (P) of 3 in. x 1¼ in. mild steel bolted to the ends. These U-shaped pieces have short bolt ends welded on, provided with wing nuts. They fit over the 9 in. x 4 in. horizontal timber used to support the outfit and the bolt ends pass through two 3 in. wide steel plates. By this means the outfit is clamped to the support in a suitable position to give proper tension on the winch chain, and it can also be loosened to slide the engine on the mounting blocks to take the chain off to allow the load to cross over to the truck and be let down. It is advisable to pour some old sump oil on the mounting block to enable the engine to slide freely when unclamped. The mounting block should be very firm and, in turn, mounted on two posts set well into the ground.

The engine is started by a removable handle from the rear shaft (D), or it may be started by pulling on the winch chain while the slings are still loose.

If the preceding paragraphs have been followed carefully, with reference to the drawings, there should be no difficulty in constructing a similar outfit. There is no reason why an engine other than an A.J.S. should not be used as the principle would be the same for most power units.

MOLASSES FOR POTASH DEFICIENT SOILS.

While recent reports received from representatives of the fertilizer trade regarding future supplies are more reassuring, it is nevertheless desirable that efforts be made to utilize existing Australian resources to the best advantage.

In relationship to potash, all of which is at present imported, this would call for better supervision in the rationing and distribution of molasses which is extensively employed in several areas as a means of building up depleted soils. For obvious reasons this by-product is most effective when applied to soils which are potash-deficient, and as far as practicable molasses utilization might be confined to areas of such lands.

In the Cane Growers' Handbook it is stated that difficulty would be experienced in spreading molasses evenly in amounts of less than 5 tons per acre. This would provide, of course, much more potash than the heaviest cane crops would need. In conversation recently, a northern cane grower pointed out that molasses applications of 2 or 3 tons per acre may be made satisfactorily, with a little care and assistance on the part of the farmer. We would definitely recommend, then, that the by-product be applied in dressings of these dimensions, where molasses is regarded largely as a source of potash to the ensuing crop. On average composition, 2 tons will provide the equivalent of 2½ cwt. of muriate of potash per acre, or as much potash as is contained in 5 cwt. of Sugar Bureau No. 3 planting mixture—the richest mixture available for such soils. In addition, it will provide organic nitrogen equivalent to about 2 cwt. of sulphate of ammonia.

It is certainly more economical to apply 2 tons per acre to each of two successive ratoon crops of cane, than to apply 5 tons per acre to first ratoons only. This is particularly true in regions of high summer rainfall, where losses of potash, due to leaching, are of a high order.

We would also stress—although it should be obvious—that after applying molasses the farmer does not require any potash in the artificial manure subsequently employed. It might be advantageous to apply superphosphate or meatworks manure in moderate amounts and a top dressing of sulphate of ammonia will be of value, especially on older ratoons.

H.W.K.

(*The Cane Growers' Quarterly Bulletin* for April.)

Control of Rats in Queensland Cane Fields.

By W. A. McDOUGALL.*

LOSSES in the canefields of Queensland, as in many other countries, are caused by rats biting into the sticks of standing cane crops; the losses vary considerably from year to year and at times are considered to be severe. It is a difficult matter to calculate, with any degree of accuracy, the loss incurred by rat attacks in any field or on a particular farm and counts, weighings, and the consequent comparisons of clean and bitten sticks give irregular and unreliable results. Varietal factors and crop type are of some considerable importance and these tend to upset most of the apparently accurate methods devised. It would seem that the best indication of the aggregate amount of cane lost is the difference between an estimate (made by a competent man) of the cane which should be harvested from particular fields or farms and that which ultimately could be actually delivered to the mill. In the computation of total loss from rat damage, extra harvesting costs (if any) should be added to cane lost and an allowance should be made for depressed C.C.S. In regard to the latter, it is seldom, if ever, that severe rat damage results in a loss of more than one unit of commercial cane sugar in cane delivered to a mill in Queensland.

From an economic viewpoint, the control of rats in canefields means the reducing of such losses to as low a figure as possible by a reasonable expenditure of money. There are two avenues of approach to this problem—viz., (1) attempts to protect the crop, despite the presence of rats, and (2) attacking and interfering with the rat population. It is considered that, under all conditions, best results will be obtained from a judicious combination of both methods, rather than from trusting completely to either one of them.

To date, the only known economic method of direct protection of cane is associated with the selection of more suitable varieties. It is known that, although under certain conditions *all* varieties may be damaged by rats, there are certain varietal characteristics which offer some degree of protection. A "rat resistant" variety should be thick barrelled, moderate to hard rinded, and not prone to lodging.

In the matter of "attacking and interfering with the rat population," the three methods usually available are clearing of harbourage, trapping, and poisoning. Trapping is expensive, and has no advantages whatsoever over poisoning, in attempts to reduce rat populations. Its chief uses in the field are in checking up on any controls, research work, and in providing useful information for the general guidance of those supervising rat control.

Of the six herbivorous or omnivorous rat species with which cane workers might come into contact, only two have any intimate relationship with close ground cover, such as grass, weeds, shrubs, &c., which is the usual conception of harbourage. These two rats are the Field Rat (*Rattus conatus* Thomas) and the Smaller Khaki Rat (*Melomys littoralis* Lonn.); the latter also inhabits, in comparatively large numbers, "palm tree" swamps where the Field Rat seldom exists unless a close floor covering is present. The harbourage of the Larger Khaki Rat (*Melomys cervinipes* Gould) and the Scrub Rat (*Rattus assimilis* Gould) is rain forest or scrub. The native habitat of *Rattus culmorum* T. & D.

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* In *The Cane Growers' Quarterly Bulletin* for April, 1940.

is very restricted and, as it seldom comes in contact with cane, this rat is of minor importance in the problem of controlling rat damage to sugar cane. The House Rat (*Rattus rattus* L.) is often present in canefields, but it also nests in scrub, trees, buildings, and in many places where the native rats are seldom found. The House Rat will be found in greatest numbers in cane situated near and in mill townships, or near farm buildings; they seldom inflict economic damage to these crops. When all cane is harvested it is these field-living *house rats* which enter buildings or dwellings; the Field Rat will not enter houses. Occasionally a Smaller Khaki Rat may be seen in a farm house and *M. cervinipes* sometimes becomes a nuisance in scrub camps. However, these intrusions are more accidental than consistent.

The species of rats damaging cane in any district will depend upon the amount of cane coming into contact with the native habitats of the different species; for example, if there is a large amount of "scrub" cane the Larger Khaki Rat will make its presence felt. The two "grass rats"—i.e., the Field Rat and the Smaller Khaki Rat—are present in all areas.

It is often stated that when and where there are a large number of rats there is extensive and intensive harbourage. This is true, of course, but it sometimes is forgotten that there is often a large amount of harbourage in known rat country but few rats. The association of harbourage with rats is much more obvious in the case of "grass rats" than it is with those connected with scrub, but both types exhibit somewhat parallel population fluctuations.

Another favourable factor of Field Rat environment is damp, friable soil. In a year of large rat populations this factor usually spreads and coincides with large areas where only harbourage (including cane) existed for any length of time during seasons of small rat populations. Nevertheless, it does not follow that this creation of large areas suitable for rat habitation will in turn produce large rat populations (e.g., heavy and prolonged wet seasons are not always followed by rat plagues); there are still other factors, which react on the rats themselves, for the production of excessive populations.

To sum up the status of harbourage destruction as an aid in the control of cane rats: Fundamentally the subjects are not sufficiently closely related to warrant any undue emphasis being placed on this point. In years of light rat infestation large scale destruction is unnecessary, and during seasons of heavy infestation, when every little help is desired, the project, carried out on a scale sufficiently large to be of any use whatsoever, would probably be both uneconomic and impracticable.

Many investigators have encountered difficulties when attempting to poison house rats. To a certain extent these difficulties do not exist when dealing with our indigenous cane rats in Queensland. Individually it is comparatively easy to poison them with a suitable bait. Also, once it has been established that a certain bait can give satisfactory results it may be used indefinitely; there is no reason to assume that a periodic change of bait will improve attempts to reduce rat populations under any of differing circumstances which may be encountered.

Under Queensland conditions baits with arsenic, red squills, barium carbonate, strychnine, and glycerol monochlorohydrin do not provide or promise the same degree of efficiency as those containing yellow phosphorus or thallium sulphate. The successful administration of thallium sulphate to rats depends upon the consumption of considerable amounts of a desired rat food and, as a bait base, wholewheat has been found to be the most suitable. Thallium sulphate treated wheat at a strength of 1:300 is recommended as the most suitable bait of this type for Queensland canefield conditions.

Yellow phosphorus paste on bread has been used as a rat bait in houses for many years. Queensland canefield rats are far from partial to bread (either fresh or stale) as a food, and the paste itself is not very palatable to these rats. Nevertheless, this very cheap bait, containing the most deadly of all known rat poisons, may be highly successful in canefields as its remarkably high toxicity carries it through. With this bait it is not necessary for a large "take" to be experienced to obtain good results. The idea of "take," mass consumption, and palatability is one which, unfortunately, has become too closely associated with the efficiency of a bait. It is submitted that a better criterion is the effect of a particular bait in reducing rat populations. In this regard phosphorus paste on bread and 1:300 thallium sulphate treated wheat are, under suitable conditions, both good despite their different palatabilities.

The thallium treated wheat bait can be weather-proofed, if desired, by packeting in weather-proof material. Phosphorus baits are commonly supposed to lose their toxicity after a few nights in the field. However, it has been found that these baits are quite toxic over a considerable period, and it is the palatability which decreases suddenly after the laying of the baits.

The addition of such materials as linseed oil or corn oil to baits does not improve or otherwise interfere with the efficiency of the baits.

In different cane areas of Queensland different methods of placing baits and times of baiting are employed. Some centres believe in continuous all-the-year-round poisoning both in harbourage and (mostly from May to November or December) in cane. Others concentrate on poisoning in grass harbourage and along headlands and partially neglect to place baits in cane. Whilst not attempting to decry the first-mentioned method, it is considered that it is unnecessarily costly: also its effect in controlling total rat populations in areas as large as cane districts is negligible compared with that exerted by weather conditions. Where rats are present, the placing of baits on ten-yard grids has been found most efficient. Smaller spacing seems unnecessary and larger distances do not cover the average wanderings of the individual rat during a reasonably short period of time.

In the past, attempts to control rats in cane by the use of baits have given mixed results. When failures occur the type of bait and/or method of laying baits and/or times of baiting are blamed. Variations in these factors are then tried. It is considered that the only steps which should be taken are to increase the amount of bait and shorten time lapses between baiting periods. Often these failures are not the fault of the particular bait being used; they are more fundamental.

On the other hand, there are occasions when rat population size and movement are such that economic poisoning ceases to provide any appreciable degree of control.

Briefly crystallizing the above discussions in the form of specific recommendations for rat control in canefields:—

1. Plant more rat resistant varieties in rat infested country and on places in farms (such as near well-grassed creeks and scrub) where past experience has shown that rats may be expected to attack cane.
2. Poison with phosphorus on bread or 1:300 thallium sulphate treated wheat; the cheaper phosphorus is quite suitable for most purposes. Place the baits on the ground on small areas (which have been cleared with a hoe or the boot) every 10 yards, along every seventh row of damaged cane. Baits should also be placed in patches of damaged cane, and in harbourage near rat-eaten cane. Baiting should commence immediately the presence of rats is noticed in the canefields. Further baits should be put out whenever and where fresh rat bites are seen in the cane.

The provision of rat baits or poison is a matter which is best carried out by the local Cane Pests Board or other central organisation.

APPLY FERTILIZERS EARLY!

We have always advocated that applications of mixed manures to plant cane should be placed in the drill—for preference, just below the cane setts. This assures the earliest possible supply of phosphate and potash to the young cane, and is especially important on lands highly deficient in these plantfoods.

If Sugar Bureau mixtures are employed, the amount of nitrogen added is insignificant. This is planned deliberately, for if the farmer has green manured the land during the fallow, ample nitrogen should subsequently be available for the full needs of the plant cane.

There are, however, certain circumstances in which these planting mixtures might be improved upon: (1) on land which is known to be highly deficient in nitrogen (that is, where sulphate of ammonia gives good results even with plant cane), and where no green crop has been grown; or (2) in every case where, for one reason or another, the farmer finds it necessary to "plough-out and replant." An early nitrogen deficiency may be so acute in these circumstances that the development of the plant cane may be seriously retarded, unless more nitrogen is applied in the planting drill.

Under such conditions, the use of Sugar Bureau *ratooning*, rather than *planting*, mixtures is advised; or, alternatively, the application of a mixture rich in meatworks manure may be substituted. Such treatments have proven particularly valuable in the Lower Burdekin district, where the application of nitrogenous fertilizers is the only plantfood treatment which gives consistently beneficial results.

H.W.K.

(*The Cane Growers' Quarterly Bulletin* for April.)

The Veterinary Medicines Acts, 1933 to 1938.

Veterinary Medicines Registered for the period January, 1939, to December, 1941.

List No. 2 (supplementary to List No. 1 issued July, 1939).* Published on 31st December, 1939, in accordance with section 6 (7) of the Acts.

F. B. COLEMAN, Registrar of Veterinary Medicines.

	Reg. No.
Animal Health Station, Yeerongpilly—	
First and Second Blackleg Vaccines	333
Bazley, C.B., Dalby—	
Bazley's Specific	1393
Buzacotts (Queensland) Limited, Brisbane—	
Bio Fowl Pox Vaccin	273
Captain Products (Queensland), Brisbane—	
Sterelin	1772
Vetrelin	2508
Pronto	2509
The Committee of Direction of Fruit Marketing, Brisbane—	
Waratah Nicotine Sulphate	1665A
Covington, Misses L. and M., Toowoomba—	
Magic Mange Cure	1928
Cramsie Dwyer and Company, Wallangarra—	
Pleuro Vaccine (Pure Culture)	1914
Blackleg Vaccine	1941
Stoctone (Concentrated) Drench	2178
G.T.S. Tetrachloride Double Strength Worm and Fluke Drench	2024
David, F. D., Brisbane—	
Happidog Vitone	2336
Denhams Proprietary Limited, Brisbane—	
"Poultry's" Canker Paint	252
Wondertone	319
Chickhealth	440
"Poultry's" Eye Roup Cure	441
"Poultry's" Great Bronchial Remedy	442
"Poultry's" Iron Tonic Mixture	443
"Poultry's" Scaley Leg Ointment	444
"Poultry's" Special Roup Cure	445
"Anticocid"	2338
Wart Ointment	2494
Duffin, C. J., Innisfail—	
Mourilyan Alterative Worm and Condition Powders	2042
Duffin's Dog Condition Powders	2319
Finney, L. W., Brisbane—	
Telson Fluke Drench	88
Telson General Purpose Drench	89
Telson Poultry Powder	234
Telson Salve	2493

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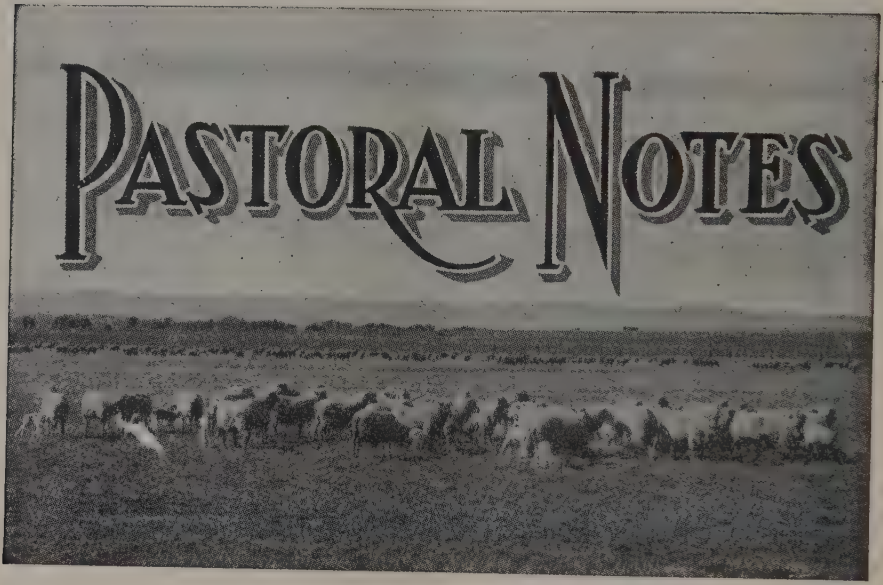
* List No. 1 was published in the "Queensland Agricultural Journal," July, 1939, page 91, together with details relating to the requirements of the Acts.

	Reg. No.
Flynn Bros., Brisbane—	
Osmond's Worm Drench and Fluke Kill	431
Osmond's "Vermiline" (Lamb Worm Drench and Tonic)	2548
Goldsbrough and Company Limited, Brisbane—	
Harton Veto-Cide	394
"Harton" Arsenical Sheep Drench	1377
Hall and Company, F., Brisbane—	
Hall Mark Blowfly and Worm Exterminator in Sheep	2489
Happidog Stores Proprietary Limited, Brisbane—	
Happidog Worm Syrup	2488
Hayes Veterinary Company, Brisbane—	
Gonadin Serum	1919
Mactaggarts Primary Producers' Co-operative Association, Limited, Brisbane—	
"Max-Tar" Dehorning Dressing	2449
McDonald and Company, A. H., Brisbane—	
Vetamac Sheep Drench	2185
Vetamac Germicide and Antiseptic	2375
Vetamac Bluestone Nicotine Worm Drench	2591
New Zealand Loan and Mercantile Agency Company Limited, Brisbane—	
Cooper's Sheep Worm Drench	2503
Cooper's Liquid Worm Remedy for Puppies and Dogs	2504
Cooper's N.C. Sheep Worm Drench	2600
Nobles Proprietary Limited, Brisbane—	
Sykes's Animal Colic Remedy	37
Norris Agencies Proprietary Limited, Brisbane—	
Sidolia Stock Drench	2498
Nyal Company, Brisbane—	
Krect Dog Ointment	2500
Parke Davis and Company, Brisbane—	
Parke Davis C.A. Worm Capsules R.B. (No. 196)	2506
Aloin Cathartic Ball (Compressed)	2522
Kamala	2592
Poultry Farmer's Co-operative Society Limited, Brisbane—	
Merval	1122
Queensland Pastoral Supplies Proprietary Limited, Brisbane—	
Stockaid Nikos	1867
Salmond and Spraggon (Australia) Proprietary Limited, Brisbane—	
Bob Martin's Tasteless Distemper Powders	422
Sharkey, S. B., Mackay—	
Sharkey's Hobble Chafe Lotion	2440
Steggall, P. M., Toowoomba—	
King's Worm Capsules	2171
King's Greyhound Tonic	2172
King's Pad Paint	2173
Stewart, S. H., Sandgate, Brisbane—	
Bot Capsule	1482
Worm Capsules	1483
Chemco Dog Condition Powder	1484

	Reg. No.
Tatnell and Graham, Gympie—	
Spedosol Powder	26
Taylors Elliotts and Australian Drug Proprietary Limited, Brisbane—	
Row's Embrocation	130
Doyle's Laryngine	168
Reducine	170
Rainbow Famous Mixture for Dogs of All Breeds	2374
Vitaforce Products (Queensland), Brisbane—	
Vitaforce Dog Soap	2556
Vitaforce Distemper Capsules	2557
Vitaforce Blue Lotion	2558
Vitaforce Puppy Worm Syrup	2559
Vitaforce Worm Capsules	2560
Webster Bros., Proprietary Limited, Brisbane—	
Pro-Vet Anti Toxic Drench	185
Pro-Vet Salve	201

Index of Brands that are not indicated in the foregoing list by the Primary Dealer's Name.

Brand.	Primary Dealer.
Bio	Buzacotts (Qld.) Ltd.
Bob Martin's	Salmond & Spraggon (Aust.) Ltd.
Chemco	Stewart, S. H.
Cooper's	New Zealand Loan & Mercantile Agency Co. Ltd.
Doyle's	Taylors Elliotts & Australian Drug Pty. Ltd.
G.T.S.	Cramsie Dwyer & Co.
Happidog	David, F. W.
Harton	Goldsbrough Mort & Co. Ltd.
King's	Steggall, P. M.
Krect	Nyal Co.
Magic	Covington, L. & M.
Max-Tar	Mactaggarts Primary Producers Co-op. Assn. Ltd.
Mourilyan	Duffin, C. J.
Osmond's	Flynn Bros.
Poultry's	Denhams Pty. Ltd.
Pro-Vet	Webster Bros. Pty. Ltd.
Rainbow	Taylors Elliotts & Australian Drug Pty. Ltd.
Row's	Taylors Elliotts & Australian Drug Pty. Ltd.
Sidolia	Norris Agencies Ltd.
Spedosol	Tatnell & Graham.
Stockaid	Queensland Pastoral Supplies Ltd.
Stoctone	Cramsie Dwyer & Co.
Sykes's	Nobles Pty. Ltd.
Telson	Finney, L. W.
Vetamac	McDonald & Co., A. H.
Waratah	Committee of Direction of Fruit Marketing.



Strangles.

THIS is an acute, contagious, febrile, catarrhal disease affecting horses, mules and asses. Young animals are usually attacked, and acquire an immunity which may be lifelong, although aged animals are sometimes affected, the disease following a mild course.

Strangles is caused by a streptococcus, which is found in the lymph glands and nasal discharges of affected animals.

There are two forms of the disease—simple strangles, which runs a relatively mild course of from three to four weeks, and a much more serious form in which the catarrh leads to broncho pneumonia and, at times, an abscess may burst internally and set up gangrenous pneumonia, or the organism infects the blood stream and sets up abscesses in the lungs, liver, spleen, and kidneys, causing death within a few days.

Simple strangles is characterised by inflammation of the upper air passages, evidenced by a cough with a nasal discharge, at first clear and watery, and later thick and yellowish with fever, and abscess formation in the lymph glands situated in the angle of the jaws (submaxillary).

The eyes become reddened and discharge, respiration is increased, and the pulse later becomes rapid and weak. The animal is listless, with staring coat and refuses food.

Treatment.—The patient should be made comfortable in an airy shed or box, and, if cover is not available, should be rugged and allowed to remain untied in an open yard, but in strict isolation from other young animals.

Feed should be offered in a box on the ground, and the appetite tempted with green stuff, bran mashes, &c., in small quantities at a time, with water constantly available, to which may be added nitrate of potash—one ounce to three gallons of water which has had the chill taken off it in cold weather.

Discharges from the eyes and nose should be removed daily with cotton wool soaked in a mild disinfectant—such as peroxide of hydrogen, permanganate of potash, or boracic, in weak solution—after which the nostrils may be moistened with olive oil, which prevents discharges from drying around the parts.

Feed boxes and buckets should be kept disinfected and free from discharges.

The development of the abscess may be hastened by the application of hot fomentations, mustard poultices, or of weak biniodide blister, when it will usually burst spontaneously. If this does not happen the abscess should be opened with a sharp disinfected knife, selecting as a site for the incision a soft spot which will be found in the swelling. Too early surgical interference is not desirable. The contents of the abscess should then be squeezed out and the wound disinfected, and kept open until the discharge ceases.

With careful nursing and good feed, recovery in most cases is rapid.

Preventive treatment consists of three inoculations with Commonwealth Strangles Vaccine at intervals of four days. Treatment of infected animals with this vaccine is valuable, but the services of a veterinary surgeon are necessary, as the dosage must be carefully watched and altered as indicated by the reaction of the patient.

"LUMPY JAW" OF CATTLE.

Actinomycosis—"lumpy jaw" or "wooden tongue"—is a common disease of cattle. There are two forms of the disease, indicated by the foregoing terms, one of which attacks the bones of the jaw and the other the tongue. Strangely enough, each form is caused by a different type of organism.

These organisms are found on the grass, and infection probably takes place through a small injury to the gums. From there they penetrate the tongue or the jawbone, as the case may be.

Advanced cases are easily recognised by the stockowner. In one form, the tongue is increased in size and may be so large as to project out of the mouth. It is very hard to the touch—hence the term "wooden." When the jaw is attacked there is often considerable swelling and pus formation. The pus works its way to the exterior, and openings are produced through which the pus flows. Extension of the process leads to the formation of several openings and the jaw may, as a result of the formation of new bone tissue and inflammatory swelling, grow to an enormous size.

Bad cases, whether of the tongue or jaw form, lead to emaciation of the animal because of the difficulty in taking food. Owners are not advised to attempt treatment of bad cases. It is better to destroy the animals, as they may cause infection of other stock.

In the case of valuable animals, if the disease is not too far advanced, treatment may be possible, and owners are asked accordingly to get in touch with the Animal Health Station, Yeerongpilly.

RESTING STOCK BEFORE SLAUGHTER.

The importance of resting stock before slaughter cannot be stressed too strongly.

Considerable loss is incurred annually through partial and total condemnation of carcases at slaughter-houses and bacon factories for bruised and fevered conditions resulting from the slaughter of animals immediately on their arrival.

Sometimes in the yarding of pigs whips or sticks are used, and a troublesome pig may receive quite a few hits before it is actually penned. Pigs are usually fat and soft and are, therefore, easily bruised. Very severe bruising, too, may be caused behind the jaws of pigs as a result of their having their heads jammed when they are being drafted into various pens. In such cases as these, where the pigs are slaughtered almost immediately upon arrival the slaughtering inspector may find it necessary to remove large areas of bruised flesh from the carcase, and may have to remove the head and, perhaps, cut up high into the neck, almost to the shoulder.

Practically all such partial condemnations of pigs would be avoided if the owners of slaughter-yards made provision for spelling the animals a few days before slaughter, so that any bruising which may have occurred shall have time to vanish.

With cattle, it is also important not to have the animals slaughtered as soon as they have been delivered, more particularly if they have travelled long distances either by rail or road.

When cattle are trucked they may be bruised, either by the horns of other beasts or by bumping against the sides of the truck while the train is in motion. Likewise, when cattle travel by road they may arrive at their destination in a condition of semi-exhaustion, because of weather conditions and the distances they have been required to travel on the hoof. When these cattle are slaughtered immediately on delivery, the inspector has almost invariably to condemn a certain amount of meat, and sometimes a whole carcase, for fever or bruising.

These condemnations would, in most cases, be avoided if the cattle were rested for a few days after their journey in order that they may recover from an injury or exhaustion before they are slaughtered.

HORSES EARN THEIR SALT.

A good farm horse is well worth his feed. Most farmers realise this, but all too frequently plough horses may be seen licking the dried sweat from each other.

Working horses are incapable of sustained effort without a liberal supply of salt, and when the food is low in this mineral they try to remedy the deficiency by licking the saline deposit from evaporated sweat round the collar, saddle, and other gear of a team mate.

It is, therefore, sound practice to keep rock salt in a convenient place for working horses.

USE OF DIPPING FLUIDS.

Dipping is a routine practice throughout the heavily tick-infested areas of the State, and all solutions used contain arsenic as their base. No other substance has been found to equal arsenic in the treatment of ticky cattle.

The dipping solutions, which are used under Government control, and are applied to cattle moving from ticky to clean country, must, by law, contain 8 lb. of arsenic per 400 gallons of solution. It has been shown, however, that this solution has a reasonably wide margin of safety and that for all ordinary purposes a solution containing 6 lb. of arsenic is effective in the treatment of ticks. It is of interest to note that the South African authorities require a solution to contain just over 6 lb. per 400 gallons.

A cheap and effective dipping solution can be made up by using arsenic and caustic soda. Six lb. of arsenic require somewhere about 2 lb. of caustic soda to dissolve it. If the two ingredients are placed in the bottom of a drum, one on each side, and water added slowly as by a cup or pannikin, and the two substances slowly mixed together with a stick, it will be found that the water commences to boil and bubble. This is due to a chemical action taking place between the arsenic and the soda, and the former is soon dissolved. Water may then be added up to 400 gallons. A dipping solution such as this is very efficient and cheap.

If washing soda is used, it is necessary to boil the solution before the arsenic goes into solution. This, however, is a disadvantage, as it takes time.

Where owners use caustic soda it is very necessary to keep the container closed very tightly, so that air does not enter. If exposed to air, the caustic soda is changed chemically by the absorption of moisture and sodium carbonate or washing soda is produced. Properly sealed containers prevent this.

MERINO EWES FOR FAT LAMB RAISING.

Fat lamb raisers may be handicapped in their industry by the scarcity of the right type of ewe. This disability applies not only in Queensland, but, to a lesser degree perhaps, in all the other States.

In Queensland, 98 per cent. of the sheep are merinos. It becomes necessary in nearly all cases, therefore, to start breeding for fat lambs with ewes of this breed.

The grazier could help the fat lamb industry and, at the same time, obtain a profitable price for ewes culled for strength of fibre on his property by supplying suitable ewes to the fat lamb raiser. This applies especially where very strong-woolled merinos are bred. There is nearly always a line of strong wool running to roughness when the type indicated is used.

The fat lamb industry can stand this roughness in the ewes, provided size and constitution are there, and both the grazier and fat lamb raiser would be well served—the grazier as to price and the lamb raiser as to type—if they could come to a business relationship.

The ewes described are really valuable to the farmer, but, unfortunately, are often slaughtered because of lack of realisation of their usefulness in the fat lamb industry.

BOTFLIES IN HORSES.

About this time of the year consideration should be given to drenching horses for bots. In determining the period of the year when drenching for these parasites will give best results, their life history must be considered.

The adult flies occur throughout the late spring and summer. During this time they lay their eggs upon the hairs of certain parts of the horse's body. These eggs hatch in time and the young larvae or bots enter the mouth of the horse. Here they remain for a certain period in the tissue of the tongue and cheeks. They eventually reach the stomach where they are to be found throughout the winter. During the late winter and spring they leave the stomach and are passed out with the dung. After a resting stage in the ground, the larvæ are gradually transformed into adult flies which eventually emerge and commence to lay eggs.

If the horse is drenched during the spring and summer, it may therefore readily become reinfested. Adult flies may still be prevalent and many eggs are yet to hatch; and there may be larvæ in the tissues of the cheeks and tongue which are protected from the drug. In the late autumn, however, all larvæ are in the stomach and are easily killed and removed by treatment.

To be most effective, all horses not only on the one farm, but on every farm in a district, should be treated during late autumn.

The most effective drug is carbondisulphide. The animals are starved for 24 hours before and for 4 hours after treatment. The drug is enclosed in a gelatine capsule and given as a ball at the rate of 6 cubic centimetres for every 250 lb. weight. Care should be taken not to allow this ball to break in the mouth as its effects may end fatally for the horse. If such an accident should happen, wash the mouth out at once with clean rain water.

COUNTING SHEEP.

It may be taken as a fact that unless one is born with or has developed an aptitude for this work he will never make a first-class sheep counter. There are many methods of counting. The novice will try and count them singly as they come—one, two, three, four, and so on. This is a very slow process, and the gate has to be very narrow if an accurate tally is to be obtained.

Some count in twos—two, four, six, eight, and so on. This again is slow where big flocks have to be dealt with, and the sheep would be better on grass than in the break.

A successful method is to count in groups of three, one up to thirty-three, and let a single sheep go and tally 100.

It is astonishing to observe the speed and correctness of two good counters, one giving delivery and the other taking delivery.

It is a rare thing when two good men are engaged to see a check count, and this applies where thousands of sheep have to be correctly tallied. Constant practice is necessary to keep in form. To this cause may be attributed the fact that many drovers excel in counting sheep.

The Dairy Farm

Care of Milking Machines.

MILKING machines, although they have revolutionised dairying methods, may, if mishandled or neglected, constitute one of the biggest menaces to milk and cream quality that the dairy farmer has to face. Many people hold the opinion that clean milk of good keeping quality and choice grade cream cannot be produced with a machine, but this has been investigated fully and both research work and practical experience have proved that it is wrong. As good a quality of milk can be produced by machine as by hand, provided the correct procedure is followed in care and cleaning.

Another objection often brought forward is that the machine tends to increase udder trouble. This is, of course, true if the farmer fails to notice cases of infection as soon as they occur and allows diseased cows to be milked by the machine. The great importance of inspecting the foremilk for any abnormal appearance should be realised, and any cow showing signs of mastitis in the first-drawn streams should be milked out by hand and the milk isolated from that used for human consumption. Cows with sore teats should also be milked by hand, although the machine may safely be used if they are left until last. A machine is very unlikely to cause teat sores—in fact, one Queensland dairy farmer with a large herd has experienced complete freedom from them over six months since he started machine milking—but it is liable to transfer the infection if used subsequently, without sterilization, on other cows.

The solution of most milking machine troubles lies in proper cleaning and sterilizing after each milking. It is essential that cleaning should be done promptly after milking is completed before the milk solids have time to dry on the rubber parts, for once dry they are far more difficult to remove completely. The first machines were crude inventions made with ordinary rubber parts which were easily cracked and pitted by the action of fat and hot water, making them excellent breeding places for contaminating bacteria. Nowadays, the modern machines are solidly built and the rubbers are of the very best quality resistant to high temperatures, so that they can safely be boiled and even sterilized regularly by steam, without injury.

The method of dealing with milking machines using a weak solution of caustic soda in boiling water is well adapted to Australian conditions and has proved economical, rapid, and successful. This method is as follows:—

(1) One gallon of clean *cold* water is drawn through each set of teat cups by suction, lifting the unit up and down in a bucket of water to allow air to mix with it.

(2) The outsides of teat cups and rubber tubing are then washed and brushed in *warm* water and caustic soda.

(3) At least one gallon of *boiling* caustic soda solution is drawn through each separate set of teat cups, holding them so that all receive equal treatment.

(4) The solution is removed completely by drawing at least 2 gallons of *boiling* water through each set of cups.

(5) If steam is available this is applied for five minutes to complete the sterilization.

Strength of Solution.—One full teaspoonful of caustic soda added to every 4 gallons of boiling water is the correct amount and, provided this strength is not exceeded, no damage will be done to the machine, and satisfactory results will be obtained. Used carelessly, however, caustic soda is dangerous in its action, and care is needed in handling it and in making up the solution. The water used must be really boiling to achieve proper cleansing and sterilization, and by this treatment the resistance of the rubber parts to cracking is actually increased.

The vacuum line is often a source of trouble, and should receive a complete flushing once each day with boiling water, care being taken not to flood the pump. All taps should be left open when the machine is not in use, and the teat cups should be hung up in a cool dust-free place. The use of chemicals other than in the washing process has been found to be unsatisfactory, and there is great danger of traces of them finding their way into the milk and cream and causing taints.

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FEEDING OF CONCENTRATES.

Farmers are often adverse from feeding concentrates which impart a flavour or "taint" to the butterfat. Peanut products are a typical example. In many cases the difficulty may be overcome by feeding the material immediately after milking. The animal then is assured of sufficient time, before the next milking, in which it can utilise the constituents liable to give the off flavours.

A COW'S AGE AND ITS EFFECT ON MILK.

How does the age of a cow influence the composition of milk? This is a question often asked. From the dairyman's point of view the fat is the most important constituent, and much experimental work has been carried out to determine how the fat test varies with the age of the cow. It has been shown that, with advancing years, cows produce milk containing a diminishing percentage of fat. The variation observed is not of any serious consequence, but it is nevertheless noticeable when average figures are taken. A cow of a high testing breed which shows an average test of 5 per cent. of fat as a young animal will decline to about 4·5 per cent. if she continues to produce to fourteen years of age.

It is sometimes thought that a heifer showing a low test as a two-year-old may improve as she matures. There are no grounds for such a belief, and any farmer building up hopes of this nature is likely to be very disappointed. The richness of milk is a matter of inheritance, and so far as is known nothing can be done to change it in an individual animal.

An interesting feature with this work is that mathematicians have taken an interest in it, and one man has actually worked out a formula for calculating the fat test for any specified age, provided that the average test for the first milking period is known.

The effect of age on the other constituents of milk has also been studied, and there is a decrease, with age, in all constituents except albumen, which increases slightly from year to year.

The effect of age on the fat test (richness) of milk should not be confused with the effect of age on milk production. There is a gradual increase in the quantity of milk produced from year to year until a maximum period is reached, after which the production figures show a slow decline. The age of maximum milk production for most breeds has been shown to be eight or nine years.

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MARGINAL CREAM.

Modern methods of manufacture and factory equipment have done much to enable the utilisation of cream, which a few years ago would have been discarded. Nevertheless, the dairying industry still offers no exemption to the general rule that the quality of raw materials directly influences the character of the manufactured product. The addition of a few faulty cans of cream to a vat may thus cause the spoilage of otherwise choice quality butter. Only a thorough knowledge of the origin and nature of a given defect can help in determining the fate of doubtful cream.

There is a limit to the capability of machinery and manufacturing technique to offset defects in cream quality, and no factory can afford to slur over defects in the cream received. Any laxity in this respect is really doing the farmer a disservice, for he may remain unaware that better-quality cream is required, and takes less instead of more care on the farm.

First-quality butter can only be obtained when the farmer realises that the remedy for cream defects is essentially his responsibility.

The PIG FARM

Pig-feeding.

GRAIN enters largely into successful pig-raising. The price of maize often makes feeding problems difficult for the pig farmer. On the mixed farm, every effort should be made to conserve the carbohydrate-rich crops—Swede turnips, arrowroot, and pumpkins—for the pigs. Molasses can be substituted for half the maize in a ration, but great care must be exercised in getting the pigs accustomed to this quantity. It should be done gradually.

Open grazing should be practised as extensively as possible; and, when porkers show a lean unthrifty appearance, it will probably pay to carry them on to bacon weight. The farmer with a good stock of feed should be wary of buying more weaners than he can feed. If the separated milk supply is not sufficient, producers are strongly advised to use the meat meal now on the market. It is an excellent substitute.

While curdled separated milk has a slightly higher feeding value than fresh milk in pig-feeding, the use of the former is not recommended as a general practice.

The usual method of souring milk on the farm is by holding it for a period in a vat or drum, which usually has an inside lining of decaying milk. This decomposing milk may contain not only the bacteria which cause normal souring of the milk, but also bacteria which are capable of decomposing the milk and turning it into a condition which is harmful to the pig. Further, when souring is practised under uncontrolled conditions, the feeding value of the milk may be greatly reduced by excessive souring.

Considering the very slight advantage of good soured milk over good fresh milk and the grave risk of an injurious decomposition of the milk when it is soured under the usual farm conditions, it is better to feed the milk fresh from the separator after the froth has been removed.

Milk should not be allowed to remain in the trough after pigs have had their meal. Any milk held over between one separating and the next should be kept in clean drums or cans, which are washed and scalded daily.

The sudden changing from sour milk to sweet milk, or from sweet milk to sour milk, in a pig's diet, may readily cause digestive disorder.

PIG-BREEDING RECORDS.

On every farm where the farmer breeds his own pigs some form of breeding record should be kept, for a record of the productivity of each sow, as well as a herd average, will contain information of much value to the observant breeder. Such records are not difficult to set out, and but a few minutes would be required each week to keep the book up to date. Therefore, a very small expenditure of time and money will ensure a supply of information which may be the means of adding materially to the income from the piggery.

A simple record may be prepared in the following way:—Take an ordinary exercise book or card, and across the top of two facing pages, or the card, rule two lines, between which the breed, name, and date of birth of the sow may be written. Then rule vertical lines to the bottom, and in the spaces between these lines there should be written such information as date of service, date of farrowing, number born, number weaned, pigs sold or killed for meat, gross returns, and remarks. In the remarks column, a note should be made of any pigs born dead, the causes of losses up to weaning, and deaths after weaning, as well as remarks concerning the type of growth rate of the litter.

When a complete breeding record is kept for each sow on the farm, the owner can, by studying the individual records, note the sows which have had small litters, or have not reared litters well, and so on. Therefore, if a sow's performance is not good, she should be replaced. By doing this, the average for the herd is raised, to the ultimate benefit of the owner.

Another use for records is to compare the results obtained from different foods. By feeding different rations to groups of pigs, and keeping a record of the amount of food eaten and the weight increases made on different rations, the farmer can determine for himself the foods which will give the greatest gain in weight for the least cost or labour.

The useful information to be gained from breeding records does more than merely compensate for the brief time and light expense involved.

Registered
Hatcheries

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains	Elmsdale	Australorps
E. J. Blake, Rosewood	Sunnyville	White Leghorns, Australorps, White Wyandottes, and Rhode Island Reds
A. F. Buchler, Milman	Pincrow	White Leghorns
J. Cameron, Oxley Central	Cameron's	White Leghorns and Australorps
M. H. Campbell, Albany Creek, Aspley	Mahaca	White Leghorns and Australorps
J. E. Caspaney, Kalamia Estate, Ayr	Evlington	White Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville	White Leghorns
R. B. Corbett, Woombye	Labrena	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme	Australorps, White Leghorns, and Rhode Island Reds
O. M. Dart, Upper Brookfield	Woodville	Australorps, White Leghorns, Langshans, and Rhode Island Reds,
Dixon Bros., Wondecla	Dixon Bros.	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick	Sunny Corner	Australorps
Elks and Sudlow, Beerwah	Woodlands	White Leghorns and Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's	Australorps and White Leghorns
Gisler Bros., Wynnum	Gisler Bros.	White Leghorns
G. Grice, Loch Lomond, via Warwick	Kiama	White Leghorns
J. W. Grice, Loch Lomond, via Warwick	Quarrington	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds
C. and C. E. Gustafson, Tannymorel	Bellevue	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby	White Leghorns and Anconas
H. Hufschmid, Ellison road, Geebung	Meadowbank	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds

Name and Address.	Name of Hatchery.	Breeds Kept.
J. McCulloch, White's road, Manly	Hindes Stud Poultry Farm	White Leghorns, Brown Leghorns, and Australorps
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
A. Malvine, junr., The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore ..	Stonehenge ..	Australorps and White Leghorns
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
J. A. Miller. Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, White Leghorns, and Brown Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric	White Leghorns
J. W. Moule, Kureen	Kureen ..	Australorps and White Leghorns
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Light Sussex, and Silver Campines
S. V. Norup, Beaudesert rd., Cooper's Plains	Norups ..	White Leghorns and Australorps
H. W. and C. E. E. Olsen, Marmor	Squaredeal ..	White Leghorns, Black Leghorns, Australorps, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Langshans, Rhode Island Reds, Light Sussex, White Wyandottes, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Douglas street, Oxley Central ..	Pennefathers ..	White Leghorns and Australorps
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Brown Leghorns, Australorps, Langshans, White Wyandottes, Rhode Island Reds
G. R. Rawson, Mains road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View ..	White Leghorns and Australorps
H. K. Roach, Wyandra ..	Lum Burra ..	Australorps and White Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns and Australorps
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, Waterworks road, Ashgrove	Smith's ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
A. G. Teitzel, West street, Aitkenvale, Townsville	Crescent ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkins' ..	White Leghorns and Australorps
W. A. Watson, Box 365, P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Atherton ..	Weaver's ..	Australorps, White Leghorns, Buff Leghorns, Wyandottes, Anconas, Indian Game, Rhode Island Reds, Barred Rocks, Buff and Black Orpingtons
H. M. Witty, Kuraby ..	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	White Leghorns, Brown Leghorns, and Australorps
R. H. Young, Box 18, Babinda	Reg. Young's ..	White Leghorns, Australorps, and Brown Leghorns

Following is a list of new applications received up to the 20th March, 1940:—

Name and Address.	Name of Hatchery.	Breeds Kept.
W. Brown, Waterworks road, Ashgrove	Strathleven ..	White Leghorns
B. Cross, Apple Tree Creek, Childers	Spring Hill ..	White Leghorns, Australorps, and Langshans
W. Easson, Formosa road, Tingalpa	Grassdale ..	White Leghorns and Anconas
B. E. W. Frederich, Oxley road, Corinda	Glen Albyn ..	Australorps
S. W. Kay, Cemetary road, Mackay	Kay's	White Wyandottes, Light Sussex, Rhode Island Reds, Australorps, White and Brown Leghorn
C. Mengel, New Lindum road, Wynnum West	Mengels ..	Australorps
P. and K. Walsh, Cleveland ..	Pinklands ..	White Leghorns

MAN AND ANIMAL—SYMPATHY, NOT SENTIMENT.

Country life is never successful when divorced from consideration of the animals which make it prosperous. Starving sheep, miserable cows, and sore-backed horses are generally owned by hard people, except when emergencies, such as drought, occur.

As care for the welfare of our stock increases, so also does our satisfaction with the job we have taken on. Money does not come into the question at all. This satisfaction is worth something far more than cash, and cannot be bought. After all, livestock must never be compared with machines. There is only one standard to use for animal comfort and that is a personal one. We have to put ourselves in the animal's place under each set of conditions and consider whether they would be comfortable to us, too. If not coming up to this standard it is not fair to expect too much from the animals under conditions less than comfortable.

Most stockowners are sincerely anxious to do everything possible, or practicable at the time, for the comfort of their flocks and herds. Some of us, however, are inclined not to think too hard about such matters as salt in the paddocks for the sheep or rugs for dairy cows and horses in cold weather.

Apart from making stock comfortable in the paddock or in the yard, there is a return worth having in the shape of the increased confidence animals develop in the man who looks after them. Any horse trainer will tell us that. There must always be a sympathetic bond—not a sentimental one—between man and animal before either reaches his best in the partnership of animal husbandry. Probably nothing puts right a man's attitude to his animals more easily than to develop his own understanding of the extent of the dependence of his stock on his efforts. This is very important, because, little as he imagines it, almost everything the stock gets comes from his own doings. Take paddocks, for example—when fenced we say with a flourish of the sweat rag: "Thank goodness, the stock are secure now." So they are, but secure from what? It is all too easy to forget that when we let stock go into a paddock from that moment we completely control their existence. No longer can they look for a belt of thick scrub to shelter from the hot summer sun or camp in on frosty winter nights, unless we have been wise enough to provide for them beforehand. It is surely up to us to provide for all emergencies so that our stock can have the most comfortable conditions of living possible in all the circumstances.

Trees for shade and shelter should be provided on every farm.

—*From "The New Zealand Farmer Weekly."*

Agricultural Notes

Fodder Conservation in Central Queensland.

THE importance of fodder conservation in Central Queensland cannot be too strongly emphasised, as the transition from an extensive to an intensive use of land has become not only desirable but necessary from an economic point of view. The irregularity of the summer, and, more particularly, the winter rainfall makes it imperative to practise fodder conservation.

Adequate supplies of conserved fodder are essential to ensure continuous production of butter and other farm products. The following suggestions may assist in achieving the desired objective:—

Rotational grazing of both native and artificial grasses ensures the most profitable use of the pasture and requires the subdivision of the grazing area into small paddocks. By grazing each paddock in rotation, the grass is fed in its most nutritious form. The young green grass—continuously available when rotational grazing is practised—possesses a high protein content and little fibre, and the nutritive ingredients are very palatable and readily assimilated by stock. Under good seasonal conditions, the stock will be unable to cope with the rapidly growing grass. The surplus should be cut when the seed head has just formed, and stored as reserve fodder.

Rhodes grass, so plentiful in the scrub or rain forest areas, as well as ordinary forest grasses, can conveniently be conserved, either as hay or ensilage. While the conservation of fodder as hay is very convenient, it is interesting to note that well-made ensilage is highly nutritive, and can be held for long periods without deterioration.

Hundreds of tons of valuable green feed, which could be converted easily into nutritious fodder, are allowed to waste away annually. During the present season, enormous quantities of pasture have been allowed to seed, and the nutritive value of the herbage lost. The value of this to the farmer, had it been conserved, would have been considerable.

Lucerne stands supreme as the most useful of all fodders. Unfortunately, the crop needs rather special soil conditions, but when these are favourable, at least a small area should be sown. It is particularly adaptable to grazing and hay-making, but the first cut or two from a new lucerne patch are often used in combination with some other form of fodder for ensilage.

The dry seasons which occur sometimes in Central Queensland demand quick-growing crops which recover rapidly after light rains. Sudan grass is better suited to these conditions than the millets. It gives heavy yields over a season's growth; it can stand repeated cutting, and provides feed well into the winter; it produces fine quality green feed, especially after the first cutting, and may be used for either hay or ensilage; and it will grow on comparatively poor soils.

Sorghums generally are especially valuable, as they provide both a bulky and nutritious fodder. Sorghum withstands dry conditions better than maize. It also thrives on poor as well as fertile soils, and provides green, succulent feed well into the winter. When grown for use with Sudan grass and cowpea, an excellent combination of crops for ensilage is provided. Sorghum should be harvested for ensilage when the seed is in the dough stage, and is best chaffed before the silos are filled.

The rainfall during the summer months is usually sufficient to produce summer fodder crops, but, unfortunately, winter rains are rather unreliable. In the more favoured areas sufficient rains occur to ensure at least good fodder crops of wheat and oats.

The benefits to be derived from conserving fodders are being gradually appreciated by farmers. Excellent crops are at present being grown in some places in Western Queensland, where the bore water is suitable. Farmers in these favoured localities should utilise the available bore water for the production of fodder crops, to some extent, at least.

NEW QUEENSLAND-BRED SEEDLING CANES.

From time to time progress reports are presented on the early performances of new and promising seedlings raised by the Bureau. Eventually certain of these are propagated for distribution, and they duly appear in the list of approved varieties for areas where they may be tried by growers generally.

It would appear from comments which we sometimes hear that, because canes are "approved" in this manner, our action is regarded as a specific recommendation for all farmers to plant them. This is certainly not correct. Farmers should appreciate that, unless a cane is listed as approved, they are not permitted to plant it, except by special prearrangement with the Bureau. When any new cane is added to a list, we mean to convey that we consider it worthy of trial, and we usually give an indication of the general conditions under which it might have value. In no circumstances is it suggested that a grower should plant more than one or two acres of any new variety which has not been tested extensively, and its true worth established.

H.W.K.

(*The Cane Growers' Quarterly Bulletin.*)

CROP ROTATION.

Rotation of crops is generally necessary in most systems of farming, if the fertility and physical condition of the soil are to be maintained. Apparently, every crop requires some particular combination of plant foods, and by growing the same crop season after season on the same soil, a depletion of the main plant foods required by that crop results. Hence, after continuous cropping for some years, yields may become unprofitable. By growing different crops in rotation, the productivity of the soil may be maintained or even improved in the case of naturally inferior types of soil.

Rotational systems vary with the climatic conditions and the range of profitable crops.

Crops used in rotational systems in various parts of the world are frequently grazed off by stock, or harvested for fodder. Any accumulated manure is thus returned to the land. Where such systems are practised, the organic matter ploughed in as dung assists in maintaining the soil in a satisfactory physical condition. Where stock-raising is less important, a green manure must be included in rotations, which include nitrogen-requiring crops, to obviate any excessive depletion of nitrogen and organic matter. If climatic conditions are suitable, crops such as cowpea, soy-bean, clovers, and other legumes can be grown and ploughed under as green manure. Such green manuring usually increases the yields of the following crops.

In dry areas, green manuring has not proved so beneficial, as the organic matter decomposes rather slowly. Long fallows have therefore been developed, particularly in wheat-growing districts. When the crop is harvested, the land is ploughed as early as possible and left in a rough state to trap all subsequent rains. If the crop is stripped, the standing straw should be burned before ploughing, otherwise it may be difficult to obtain a compact seed-bed, and there is some risk of the following crop being deprived of nitrogen.

Crop rotation has received little attention in Queensland, because of the natural fertility of soils which have only been cultivated for a comparatively short period. Climatic conditions have also favoured the cultivation of a particular crop within a well-defined area. As a result, crops such as wheat, cotton, peanuts, and arrowroot are more or less confined to districts which have proved suitable for their successful production.

The need for a more diversified farming system, using a variety of crops in rotation, is clearly necessary in some old cultivations where specialisation in one crop has both decreased fertility and impaired the physical condition of the soil.

Properly devised rotational systems can be expected to yield larger crops, to ensure economy in the use of manures, and generally result in the more profitable working of the available land.

HEAVIER SEEDING FOR POONA PEAS.

Reference has been made previously to the fact that Poona pea is grown less on the alluvial soils of Bundaberg than on any other soil type in the area. It was pointed out that with their naturally high moisture supply large crops could be grown on the river lands almost independently of the season, and that it is on these lands that an increased nitrogen supply is generally most needed.

Growers on the alluvial country have frequently pointed out that the grassy and weedy nature of their farms is the principal reason that Poona pea crops are not grown. They claim that the pea crop will not prevent the development of grass and weeds—which seed during the growth of the peas—and thus a further supply of unwanted seeds is ploughed into the ground when the peas are turned under. It is preferable—they argue—to keep the land in bare fallow, and cultivate to kill weeds until ready for planting.

There is much in the above arguments on these particular soils, but a recent experiment of a Bundaberg river farmer throws a new light on the subject. The normal seeding of Poona pea in Bundaberg is 15 lb. per acre. This is ample in most soils to give a good cover, though sometimes a little grass may be seen surviving amongst the crop. The farmer referred to above sowed his river land with 40 lb. of Poona pea seed per acre. After germination the young plants were so thick that they rapidly covered all the ground surface, developed into a tall heavy crop, and at time of ploughing in no weeds or grass could be found in the field. Such weed and grass seed as germinated was shaded out and died—thus giving the same effect as cultivation on bare fallow. At the same time the grower obtained a crop which cannot fail to improve the subsequent cane crop. Another benefit accruing from the heavy seeding—and this time an unexpected one—was the fact that the Poona pea main stems were thinner and less woody than is usual in more thinly planted crops; this made ploughing in easier.

During the same season a grower on the red forest sandy soil near Bundaberg reported identical results with a 40 lb. per acre seeding. Weeds and grass were again smothered, a thin-stemmed crop of peas of more than normal height was obtained, and a distinct improvement was noted in the ease with which they were cut by the disc and turned into the soil.

N.J.K.

(*The Cane Growers' Quarterly Bulletin.*)

THE FARMERS OF THE FUTURE.

No educational movement of recent years has made greater progress than the junior farmer club movement, as represented by the school project clubs in Queensland and the junior farmers' clubs in the other States.

In New South Wales the number of junior farmers' clubs is now over 350, with a membership of nearly 9,000, of whom over 3,000 are boys and girls who have left school. The girls and boys themselves actually held just over 100 club and district shows last year. The quality of the exhibits prepared by the young farmers has everywhere improved in both stock and produce. Many juniors are now members of the registered stock societies. Many boys win in open competitions, some have quite large dairy herds, and some fathers have followed their sons' advice in the improvement of pastures, in the growing of lucerne, and in farm management generally.

These are only a few indications of what the junior farm club movement means to the youth of our land, to the primary industries, and to the country generally.

Horticultural Notes

How to Plant a Deciduous Fruit Tree.

FROM the time trees leave the nursery until they are permanently planted, they should never be left exposd to sun, wind, or air, when it possibly can be avoided.

Trees waiting for planting should be heeled-in with moist earth about the roots, and only taken out of the ground when actually needed for setting. The hole dug for a tree should be large enough to permit the roots to spread out naturally in all directions. It is unnecessary to dig wide holes if the trees are heavy-rooted, for the roots must be trimmed back at transplanting time.

All broken, torn, and dead roots should be cut back to fresh living wood. When the clean cut surfaces come in contact with moist soil. new roots are formed very readily.

Filling in the holes is most important in planting the tree. To get the best results, moist soil must be placed closely around the roots, preferably by hand, so that no air holes or crevices are left.

When the trees are placed in position, the roots are spread out and a shovelful or two of fine earth thrown in upon them. The soil should be carefully worked in between the crevices and, when the hole is about one-third full, the soil about the roots of the tree should be tramped down firmly. Moving the tree up and down, while the earth is being filled in, will assist materially in eliminating air holes and in bringing the soil into close contact with the roots. There is little danger of the earth being over-packed, but trees often die for lack of tramping.

After the roots are all covered and packed in tightly, the hole may be filled in with loose soil. Tramping the top of the ground after completely filling the hole is undesirable.

When planting the tree allowance must be made for the looseness of the ground in deciduous fruit areas in the Stanthorpe district. If the tree is set only as deep as the collar, it will be well out of the ground twelve months later, when the land has settled down. Hence, to ensure the best results, the collar of the young tree should be from 4 to 6 inches below the surface of the ground. In twelve months' time the collar will be at the proper depth—namely, level with or just under ground level.

If possible, trees should be planted not later than the end of July. The root system will then be established before the buds start to shoot. Later planting is apt to be too great a tax on the tree's resources.

Since the roots have been cut back prior to planting, it is necessary to cut back the top of the tree proportionately in order to maintain a balance between the top and the root. If this is not done, the tree, when it comes into leaf, will lose moisture faster than the reduced root system can supply it, and death may result.

A tree should be headed low—the best height being 18 inches to 2 feet. The most uniform orchards are made by setting whipsticks in preference to headed trees. With whipsticks, the grower can form any desired type of head, whereas trees headed in the nursery often possess badly formed heads which have to be cut off and re-formed in the orchard.

Three, or at most four, main limbs at the start are enough for any fruit tree. If properly placed on the trunk, it will never be necessary to cut out a large limb—a step which is undesirable except in the most extreme cases.

The main limbs should not all start out at the same height from the trunk, for if all the weight of limbs and of fruit is directed at a single point, the tree is liable to split. Opposite crotches should be avoided.

The after-cultivation of freshly-planted trees, as well as all other trees, is most important. It is a loss of both time and money to plant trees unless the orchardist is prepared to look after them. Young trees left to struggle against weeds, drought, and a poverty-stricken soil suffer severely. If, by chance, they do survive, they become stunted, and are never of much value. Great care is necessary in cultivating an orchard, for the careless use of horses and implements can do very great harm to the trees.

CABBAGE-GROWING FOR MARKET.

The cabbage is one of the most important vegetables for the market gardener. It grows best in the cooler districts, but by carefully selecting varieties the crop may be grown in most parts of Queensland.

The seed should be sown in beds of well-drained, deeply and thoroughly worked soil. The soil, if heavy, should be improved by the addition of sand or decayed vegetable matter; if poor and sandy, the addition of a loamy soil or well-rotted manure will be beneficial.

The surface of the bed should be fertilised and firmed, and the seed sown thinly in shallow drills about 4 inches apart. After sowing, mulch the bed with well-rotted leaf mould to prevent excessive evaporation of moisture.

The seed-bed must be watered regularly, for a check on the growth of young seedlings is often followed by unsatisfactory results.

When large enough to handle, the seedlings should be thinned to an inch apart, for if grown too thickly they develop into long, spindly, weak plants.

Shading during the hottest part of the day is often necessary, but this shade should be removed as soon as the plants are strong enough to withstand the heat. Overshading also produces spindly plants. Approximately 1 lb. of seed will provide sufficient plants for an acre of cabbage.

In about six weeks the young plants should be large enough for transplanting. They may then be hardened off by restricting water supplies for a day or two before their removal to the field. Transplanting should be done in cloudy or showery weather, but if weather conditions are unfavourable the young seedlings should be watered in, and, as a further precaution, the top half of the leaves may be trimmed off to lessen transpiration until the root system is established.

Loosening of the soil in the seed-bed with a fork before lifting the plants helps to save many of the small roots. If the bed has been well soaked previously, the plants will lift with a ball of soil adhering to the roots, which will help to keep them moist.

The roots of the young plants should be kept damp after removal from the bed, and this may be done by standing them in a bucket containing a puddle of soil and water.

In planting, a hole is first made in the ground with a dibble—an old spade or digging fork handle is suitable. The hole should be only deep enough to allow the roots of the seedling to reach the bottom of the hole. Turn in a little earth, and then draw the plant slightly upwards before pressing the soil firmly around it. This ensures that the main root will not be doubled up.

The plants should be in rows 3 feet apart; in the rows the smaller varieties should be spaced 2½ feet and the larger varieties 3 feet apart. The growth of cabbages should on no acocunt be checked. Regular cultivation and watering are, therefore, essential.

The right varieties should be selected for different times of the year. Winter-planting types should be early and quick maturing.

In the cooler areas, seed of the early varieties is sown during autumn. Main crop varieties are sown between August and December. The coastal districts are best suited to the winter crop.

Cabbage should be marketed as soon as possible after cutting, and only good, firm-hearted vegetables should be sent for sale. Care in handling is essential, and when placed in bags for railing they should be packed as firmly as possible.

Recommended varieties are:—

Early.—Early Allhead and Early Drumhead, both of which are large, early, and quick growers.

Main Crop.—Succession is the most popular variety, and may be grown almost any time. It is a good large Drumhead type.

Surehead is slightly larger than Succession. It is hardy, and, may be planted closer in the rows, as it has fewer outside leaves.

HANDLING CITRUS FRUITS.

The harvesting of citrus fruits will soon be in progress, and for several weeks to come growers will be chiefly concerned in the marketing of their crops.

Care in the handling of citrus fruits pays the grower handsomely. Rough handling contributes towards wastage losses in export fruit and in fruit being held by local markets, because, chiefly, of green and blue moulds, which are familiar to every citrus-grower.

These moulds are fungal parasites disseminated by means of spores which chiefly gain entrance to the fruit through bruises and skin abrasions.

The healthy unbroken skin of the orange is proof against almost all decays.

Abrasions may be caused during picking operations by the finger nails of careless pickers, or by allowing the clippers to cut into or prick the rind of the fruit when cutting the stem.

By the use of clippers with cup-shaped blades and rounded points, there is no excuse for the fruit being clipper-cut whilst the gloves on the hands will prevent finger-nail injury.

All stems should be cut off short and smooth; otherwise they are likely to puncture the skin of other oranges during handling.

Another source of damage is protruding nails on the inside of the picking boxes, the points pricking into perfectly good oranges, causing punctures through which spores may enter.

The picking boxes should be well made; the internal surfaces of the boxes should be finished smooth to avoid friction during transit of the fruit from the orchard and the packing shed.

It is not only necessary for the orchardist himself to be careful, but he must also see that his employees are not negligent.

In the packing shed most growers make some provision to ensure cleanliness; nevertheless, there are some who do not appreciate the obvious necessity for hygiene. Occasionally uncovered buckets and tins are observed containing mouldy fruits in various stages of breakdown which are allowed to accumulate from day to day. Where this occurs, those responsible for the cleanliness of the shed fail, apparently, to realise the enormous number of spores produced from mouldy fruit which are dispersed in the form of "mould dust" capable of reproducing the same decay in all punctured and bruised fruit with which it comes in contact. It is essential that all waste and reject fruit which accumulates during each day's work should be effectually destroyed daily by burning. Moreover, a frequent washing of the floors of the packing shed with a ½ per cent. caustic soda solution, or other suitable fungicide, will reduce mould contamination within the shed.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

WITH winter approaching, growers should allow their fruit to advance further in colour and ripeness. This applies particularly to pineapples and papaws for Sydney and Melbourne markets. Complaints have already been received from the South as to the immaturity of some consignments. With colder weather the risk of overripe deliveries is greatly lessened. For that reason, too, it takes longer for immature fruit to ripen, hence the wisdom of allowing fruit for winter disposal to show more evidence of ripening than is usual with summer consignments. Notice should be taken of complaints about unripeness, otherwise prohibitive action may become necessary in the interests of consignors as a whole. It is hardly fair to allow a market to be spoilt by a few growers who ought to know better than to send unripe fruit to the South.

Water blister in pineapples and "squirter" in bananas have been troublesome. More care in handling would help to reduce loss from these causes.

Grapes generally have been of excellent quality, but later deliveries were evidently affected by adverse weather. Citrus fruits are selling at nearly normal values. Complaints of unripeness of citrus fruits have also been rife. It is just as well to understand clearly that the buyer does not want green fruit, and if some growers persist in sending it the inevitable result will be a lessened demand, and so, again, the majority may have to suffer for the thoughtless or careless few.

Prices for the last week of April:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Smalls, 11s. 6d. to 15s.; sixes, 12s. to 18s.; sevens, 14s. to 20s.; eights and nines, 17s. to 22s.

Bunch bananas.—

Cavendish, 2d. to 7d. dozen.

Lady Fingers, 2½d. to 9d. dozen.

Sugars, 2d. to 6d. dozen.

Sydney.—Sixes, 14s. to 18s.; sevens, 16s. to 21s.; eights and nines, 18s. to 24s.

Melbourne.—Sixes, 12s. to 17s.; sevens, 14s. to 19s.; eights and nines, 16s. to 21s.

Adelaide.—To 24s. tropical case.

Pineapples.

Brisbane.—Smoothleaf: 3s. to 7s. 6d. case; specials higher. Loose: 2s. to 3s. dozen. Roughs: 6s. to 9s. case; 2s. to 6s. dozen.

Sydney.—7s. to 12s.; few higher.

Melbourne.—Smoothleaf: 7s. to 13s. per tropical case.

Water blister prevalent.

Papaws.

Brisbane.—Yarwun, 5s. to 8s. 6d. tropical case; Locals, 2s. to 5s. bushel case.

Sydney.—7s. 6d. to 14s. tropical case.

Melbourne.—14s. to 18s. tropical case.

Custard Apples.

Brisbane.—2s. 6d. to 4s. half-bushel case.

Sydney.—4s. to 6s. half-bushel.

Melbourne.—4s. to 6s. half-bushel.

Monstera Deliciosa.

Brisbane.—2s. 6d. to 3s. 6d. per dozen.

CITRUS FRUITS.

Oranges.

Brisbane.—Navels: 7s. to 12s. case. Commons: 5s. to 8s. case.

Sydney.—Queensland, 8s. to 12s.

Brisbane.—Locals, 7s. to 12s.; Gayndah, 8s. to 16s.

Mandarins.

Brisbane.—Emperor: 7s. 6d. to 12s. Fewtrells: 6s. to 9s.

Sydney.—Emperor: 10s. to 14s. Fewtrells: 8s. to 11s.

Melbourne.—Emperor: 14s. to 16s. Fewtrells: 8s. to 12s.

Grapefruit.

Brisbane.—4s. to 9s.

Sydney.—Queensland, 8s. to 12s.

Melbourne.—9s. to 13s.

Lemons.

Brisbane.—Locals, 7s. to 12s; Gayndah, 8s. to 16s.

Sydney.—Queensland, 9s. to 16s.

Melbourne.—9s. to 14s.

OTHER FRUITS.

Passion Fruit.

Brisbane.—Firsts, 16s. to 20s.; seconds, 10s. to 15s.

Rosellas.

Brisbane.—2s. 6d. to 3s. 6d. sugar-bag.

Grapes.

Brisbane.—Waltham Cross, 10s. to 13s. case; Purple Cornichon, 10s. to 14s.; Muscatels, 7s. to 11s.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Granny Smith, 11s. to 13s.; Duke Clarence, 7s. to 8s.; Jonathan, 7s. to 10s.; Cleopatra, 8s. to 10s.; Alfristan, 7s.; French Crab, 6s. to 10s.; Delicious, 8s. to 11s.; Scarlets, 7s. to 9s.; Ribston Pippin, 5s. to 6s; Cox's Orange, 5s. to 6s.

Pears.

Brisbane.—Beune de Capimont, 9s. to 10s.; Beune Anjou, 9s. to 11s.; Winter Cole, 10s. to 14s.; Packham's Triumph, 9s. to 12s.

Tomatoes.

Brisbane.—Ripe, 1s. 6d. to 5s.; Coloured, 4s. to 8s.; Green, 4s. to 6s.

MISCELLANEOUS, VEGETABLES, &c.

Cabbages.—Local, 4s. to 8s.; Stanthorpe, 8s. to 12s.

Cauliflowers.—4s. to 16s. dozen.

Beans.—Brisbane, 3s. to 8s. bag; Sydney, 6s. to 14s. bushel; Melbourne, 5d. to 6d. lb.

Peas.—7s. to 14s. bag.

English Potatoes.—5s. to 7s. sugar-bag.

Sweet Potatoes.—2s. to 3s. bag.

Parsnips.—6d. to 1s. 6d. bundle.

Carrots.—4d. to 1s. 3d. bundle.

Beetroot.—6d. to 2s. bundle.

Lettuce.—9d. to 3s. dozen.

Chokos.—4d. to 9d. dozen.

Pumpkins.—Brisbane, 4s. 6d. to 6s. bag; Sydney, 6s. to 10s. cwt.

Marrows.—1s. 6d. to 5s. case.

Cucumbers.—Brisbane, 5s. to 7s. bushel; Sydney, 6s. to 10s. bushel.

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SPORTSMANSHIP IN THE SHOW RING.

To be successful, every show exhibitor has to be a sport. Stockowners who have given many years to breeding and exhibiting show stock are usually good winners and good losers. The compliment of being a good winner or a good loser is even better than that of being a good breeder or a good exhibitor of live stock. To be a good winner or loser is a virtue which all exhibitors at our shows should possess, and it is a virtue that builds friendship. To be one who can gracefully win or lose in sporting acceptance of the judge's verdict—or, in the language of the day, one who "can take it"—is to have every real sportsman's respect.

The world admires a good winner, but it admires a good loser even more.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, the Jersey Cattle Society, and the Friesian Cattle Society, production charts for which were compiled during the month of March, 1940 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
	AUSTRALIAN ILLAWARRA SHORTHORNS.			
	Mature Cow (Standard, 350 Lb.).			
Rhodesview Strawberry 2nd	W. Gierke and Sons, Rhodesview, Helidon	10,884·27	400·255	Rhodesview Red Knight
	Junior, 4 Years (Standard, 310 Lb.).			
College Gold 3rd	Q.A.H. School and College, Lawes	10,190·69	405·278	Trevlac General
	Senior, 3 Years (Standard, 290 Lb.).			
Glen Idol Daphne	Estate P. Doherty, Box 31, Gympie	9,100·35	364·485	Excellency of Blacklands
Glen Idol Daphne 2nd	Estate P. Doherty, Box 31, Gympie	9,059·75	338·754	Excellency of Blacklands
Alfa Vale Gladys 3rd	J. E. Heath, Springlea, Merlwood, Murgon	7,678·7	308·369	Reward of Fairfield
	Senior, 2 Years (Standard, 250 Lb.).			
Rhodesview Nancy 22nd	W. Gierke and Sons, Rhodesview, Helidon	7,638·71	338·385	Rhodesview Red Knight
College Raceme	Q.A.H.S. and College, Lawes	8,294·28	330·663	College Sergeant
Glengarry Heatherbell	G. Waugh, Glengarry, Peeramon	7,369·35	309·417	Blacklands Patron
	Junior, 2 Years (Standard, 230 Lb.).			
Trevlac Hazel	W. V. Lubke, Glamorganvale	7,917·5	304·27	Trevlac Hinkler
Glen Idol Primrose	Estate P. Doherty, Box 31, Gympie	9,424·4	372·807	Excellency of Blacklands
Happy Valley Artdene	R. R. Radel, Happy Valley, Coalstoun Lakes	6,146·00	278·231	Sunnyview Artist
Boah Peak Ruby 2nd (265 days)	Mrs. E. E. Bruggemann, Boah Peak, Silverleigh	7,130·25	263·222	Glenroy Admiral

JERSEY.

MATURE COW (STANDARD, 350 LB.).

Kensington Fairy Queen	Miss J. Nowlan, Lindum	6,761·2	369·464	Trinity Recompense
Lyndhurst Pussy	J. Sigley, Millaa Millaa	7,249·00	353·226	Lyndhurst Butter King

JUNIOR, 4 YEARS (STANDARD, 310 LB.).

Keystone Mintie	E. J. Keys, Proston	8,364·75	431·862	Trinity Bright Royal
Oxford Rosary	E. J. Keys, Proston	6,302·45	345·836	Oxford Rivoli

SENIOR, 3 YEARS (STANDARD, 290 LB.).

Bellefaire Pride's Exaltation	J. Richardson, Oakwood	5,529·11	341·436	Design's Soeurette Pride
Keystone Claribelle	E. J. Keys, Proston	5,932·8	305·002	Gunawah Gamboge Prince
Bellgarth Opal 2nd	K. W. Gadsby, Bonathorne, Jandowae	5,742·76	296·529	Trecarne Renown 2nd

SENIOR, 2 YEARS (STANDARD 250 LB.).

Hocknell Golden Girl	N. C. Webb, Beaudesert	8,050·77	428·56	Bremerside Zilla's Boy
Hopewell Mavoureen	Geo. Hurley, Childers	5,647·96	353·575	Carnation's Queen Golden
Inverlaw Lady Myrtle	R. J. Crawford, Inverlaw, Kingaroy	5,650·78	339·462	Little Jack of Inverlaw
Tecoma Bunnie	W. J. Semgreen, Tecoma, Coolabunia	5,090·9	305·418	Bruce of Inverlaw

JUNIOR, 2 YEARS (STANDARD, 230 LB.).

Inverlaw Phyllis	R. J. Crawford, Inverlaw, Kingaroy	9,756·3	543·939	Oxford Royal Lad

FRIESIAN.

SENIOR, 2 YEARS (STANDARD, 250 LB.).

Tent Hill Stella	W. H. Grams, Upper Tent Hill, Gatton	9,876·12	336·74	Tent Hill Starlings Actuary

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General Notes

Staff Changes and Appointments.

Mr. K. L. Coates, Macnade Sugar Mill, Halifax, has been appointed mill-owners' representative on the Macknade Local Sugar Cane Prices Board in place of Mr. N. S. Beatty.

Constables J. S. Toohill and H. N. Smith, Chinchilla, have also been appointed inspectors under the Brands Acts and the Slaughtering Act; and Constable P. B. Guymer, Warra, also has been appointed an inspector under the Brands Acts.

Mr. E. T. Lewin, inspector of stock, Department of Agriculture and Stock, Brisbane, will be transferred to Boonah.

Messrs. A. L. Gabriel, Merrimac, Mudgeeraba, and A. Turner, Homebush, via Mackay, have been appointed honorary protectors under "*The Fauna Protection Act of* 1937."

The appointment of Mr. N. G. Monroe as an inspector under the Stock, Slaughtering, and Dairy Produce Acts, Department of Agriculture and Stock, has been cancelled, and Mr. D. S. Robertson has been appointed to the vacancy.

Mr. A. G. Colyer, Tidalmaree, Benaraby, has been appointed an honorary protector under "*The Fauna Protection Act of* 1937."

The following have been appointed honorary protectors under the Fauna Protection Act:—Messrs. C. F. Schultz (Woodhouse Station, Ayr), W. Gunn (Kildonan, Goondiwindi), D. W. O. McIntyre (Strathmore, Toobeah), H. P. McIntyre (Gradna, Talwood), and S. O. D. Arthur (Keetah, via Yelarbon).

Central Coast Stallion District.

A Proclamation has been issued under the Stallions Registration Acts amending the description of the Central Coast Stallion District to include the petty sessions districts of Clermont, Emerald, and Springsure. The Central Coast district formerly comprised the petty sessions districts of Gladstone, Mount Morgan, Banana, Rockhampton, and St. Lawrence.

Canary Seed—Surplus Production.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock), in a recent statement on the canary seed position, said he wished to bring to the notice of farmers on the Darling Downs the fact that the statistical position in relation to supplies of canary seed was such that no justification existed for continued production of this crop on the scale which had been reached in recent years. It was disturbing to the market, continued the Minister, that the record canary seed crop, garnered after the bounteous season of 1938-39, should have coincided with increasing production of canary seed in the Southern States, and with a reported decline in the popularity of keeping caged birds as a hobby.

As a result of these factors, trade channels are well stocked with canary seed, and the condition of the industry would be safeguarded and improved if growers refrained from growing the crop for the production of seed this season.

In the past two seasons, the Canary Seed Board had been able to obtain bank finance for the payment of advances to growers, only with the assistance of a Government guarantee. The guarantee was given in respect of the past season's crop to give the industry breathing time in which to set its house in order. The guarantee was made available on condition that the Canary Seed Board prevailed on growers to reduce production substantially during the coming season.

The canary seed plant is a valuable fodder crop, and where plantings have already been made they should be fed off or converted into hay for feeding to animals, and so be eventually marketed in the form of meat or milk for a better return than appears to be obtainable for the sale of seed from the crop.

The Minister added that with the facts and figures at his disposal it was clear that neglect on the part of the growers to respond to this suggestion could only result in a state of chaos and disorganisation from which the industry may not recover for many years.

Canary Seed Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts, amending the constitution of the Canary Seed Board to provide that elections of growers' representatives on such Board shall be held triennially, and that such representatives shall hold office for a period of three years.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of Mr. C. T. White, Government Botanist.

A Native Panic Grass.

T.W.K. (Feluga, N.Q.)—

The specimen is *Brachiaria miliiformis*, a native panic grass, for which we have not heard a local name. It is fairly widely spread in Queensland, but is mostly found in old cultivation areas or where ground has been disturbed. When found as a member of the ordinary pasture, it generally appreciates loose, sandy soil. The grass is generally regarded as of high feeding value, as palatable to stock, and is worth fostering.

Johnson Grass.

N.C.L. (Texas)—

Your specimen is Johnson grass (*Sorghum halepense*). This grass, like other members of the Sorghum family, contains a prussic-acid-yielding glucoside, and there is always a certain risk in feeding it to cattle. Cattle should never be allowed on to it on an empty stomach.

Blue Grass. Pitted Blue Grass.

R.K.B.M. (Wondai)—

1. *Dichanthium sericeum*, Blue Grass. Generally regarded as one of the best and most palatable of our native grasses.
2. *Bothriochloa decipiens*, Red Leg, Bitter or Pitted Blue Grass. A very inferior species that frequently overruns eaten-out country.

Spiny Burr Grass.

R.B.M. (Toowoomba)—

The specimen forwarded is *Cenchrus pauciflorus*, commonly known as Spiny Burr Grass in New South Wales. It is a native of America, and has probably been in Australia for many years. In Queensland it is, so far, only met with on the Darling Downs, where it seems to be spreading. Elsewhere it is usually regarded as a pest, mainly of sheep, as it catches in the wool and is extremely difficult to remove, as well as causing irritation when it penetrates as far as the skin. In America, it is reputed to be one of the most difficult burrs to remove from wool. Where possible, its spread should be prevented, although it has not yet become a serious pest in this State.

Bean Vine. Silk Cotton Tree.

C.J.G. (Brisbane)—

The plant with the pods and large black seeds is *Mucuna gigantea*, sometimes known as black bean or bean vine. It has a wide distribution in coastal Queensland and is not known to possess any economic properties. The pods are covered with short hairs, which are very irritating if they get between the fingers.

The silky material is from the silk cotton tree *Bombax malabaricum*, a tree with a wide distribution through India, the Malayan region, New Guinea, and Northern Australia. The silky cotton surrounding the seeds can be used as a substitute for kapok, but is very inferior to true kapok, and the demand for it is very limited. We do not know of any market for it in Australia.

A Native Sorghum.

R.C.B. (Chinchilla)—

The specimen is *Sorghum leiocladum*, a native Sorghum with a fairly wide distribution in Queensland, and especially common in some parts of the Darling Downs. It is a fairly useful fodder of a rather coarse sort for cattle.

"Cape Cotton."

H.C. (Crow's Nest)—

The specimen is *Gomphocarpus fruticosus*, variously known as "Cape cotton," "wild cotton," "milky cotton," and "white cotton." It is a very common weed in parts of Queensland, particularly on scrub areas, where it is very common as secondary growth. Cattle usually avoid it. It belongs to a dangerous family (Asclepiadaceae) which contains many poisonous plants, and it has always been regarded as definitely harmful to stock. Feeding tests carried out at Yeerongpilly have mostly yielded negative results, except in one case, when a sheep died, exhibiting post-mortem symptoms as follows:—"Slight congested areas along the alimentary tract, some hæmorrhages under pleura, congestion in vessel of heart. Trachea and bronchi slight congestion. Parenchymatous organs slight congestion."

"Wild Gooseberry."

M.D.O'D. (Lowood)—

The specimen is a species of North American Ground Cherry or Wild Gooseberry, *Physalis subglabrata*. This is a perennial species of gooseberry, propagated not only by seed but also by underground stems, which, when broken up, are capable of forming fresh plants. The plant has been established in Queensland for some years, but does not seem to have spread very rapidly. It is, however, possible that it may become a bad weed pest if not checked, and eradication should be attempted wherever possible. Constantly cutting off the new green shoots in order to starve the underground portions will eventually exhaust the plant in a small area. This would have to be done probably at least once every fortnight at the least for some little time. Plants like this are usually susceptible to poisoning by weak arsenical solutions, which, however, are difficult to use where stock are depastured.

"Coolibah Grass."

A.B.H. (Noondoo)—

The specimen is Coolibah Grass, *Thellungra advena*. This grass is sometimes called Coolibah Mitchell, although we do not like this local name, as the grass is not related to the Mitchell grass proper. It is also sometimes called "never-fail," a name applied, however, to a number of grasses in Western Queensland. We were very interested in your remarks on it, as reports on its fodder value in Queensland are rather conflicting. The grass has rather an interesting botanical history, and was first named from refuse from a dump outside woollen mills in Switzerland, and was not recognised in Australia until comparatively recently, having been confused with a much inferior sort.

Bamboo.

C.R.A. (Jambin)—

If you want a big bamboo, the common bamboo of Queensland is *Bambusa arundinacea*. You may probably obtain offshoots suitable for planting of this from Mr. H. G. Simmons, Curator, Botanic Gardens, Rockhampton. It would be as well to obtain the price from him before ordering. If you only want a smaller bamboo, such as the one used for fishing rods, the Black Bamboo, *Phyllostachys nigra*, would be satisfactory. A plant sometimes called Bamboo in Western Queensland is *Arundo donax*, the Spanish Reed. This grows well from cuttings or clumps, and is very useful as a windbreak, about 10 to 12 ft. high. It is sometimes planted with good effect around earth tanks.

White Passion Vine.

J.M.D. (Yeppoon)—

The specimen is the White Passion Vine (*Passiflora alba*), a native of Brazil, but now naturalised in Queensland. It is abundant in some parts of South-eastern Queensland, especially at Tamborine Mountain and around Beaudesert. Feeding tests show that it is poisonous to stock, but cattle have to eat great quantities of it before ill-effects are noticed. The fruits are not known to contain any poisonous or harmful properties, but have rather an unpleasant flavour, if we remember rightly.

Plants from Oakey District Named.

K.E.V. (Crosshill, via Oakey)—

1. *Chenopodium triangulare?* Fish Weed, a very common plant in Queensland. Stock eat it readily enough, particularly when it's dying off, but it gives an objectionable fishy flavour to milk and cream, hence the local name.
2. *Erigeron linifolius,* Horse Weed.
3. *Solanum ellipticum,* Potato Bush.
4. *Myoporum debile,* a procumbent plant fairly common, but for which we have not heard a local name.
5. *Helichrysum apiculatum,* Small Everlasting.
6. *Indigofera* sp., a species of indigo. This plant should be distinguished from the common Darling Pea, of the Darling Downs and parts of New South Wales, which also is frequently called Indigo.
7. *Ruellia australis,* a plant for which we have not heard a local name.
8. *Calotis lappulacea.* The seed-heads form nasty burrs, and are one of the common "bindy-eyes" of Queensland. We have also heard the plant called "Bogan Flea." The seeds get into clothing, blankets, and are rather a nuisance.
9. *Ajuga australis,* Australian Bugle.
10. *Oxalis corniculata,* Wood Sorrel. This plant is very common in Queensland and is distributed from the coast to the interior. It is very abundant frequently in brigalow country, and is sometimes mistaken for a clover. It does not belong to the Clover family, however.
11. *Evolvulus alsinoides,* a plant of the Convolvulus or Morning Glory family.
12. *Verbascum virgatum,* Twiggy Mullein, a native of the Mediterranean region, probably introduced as a garden plant, now quite common in Queensland, but not a particularly bad weed.
13. *Gnaphalium japonicum,* Cud Weed.
14. *Chenopodium carinatum,* a little plant of the Saltbush family, for which we have not heard a local name.
15. *Boerhaavia diffusa,* Tar Vine.
16. *Zornea diphylla,* a legume for which we have not heard a common name. It is very common in Queensland pastures, and is generally regarded as being good fodder.

You did not say whether you kept duplicates, so the specimens are being returned to you under separate cover. The usual plan is to number each specimen, retain duplicates similarly numbered, when names corresponding to numbers will be returned.

Glycine Pea, Sweet Melilot—Two Useful Plants.

(E.W.B. (Atherton)—

1. *Glycine tabacina,* Glycine Pea, a native plant with a wide distribution in Queensland. It is a legume, and is generally looked upon as rather a useful plant in the mixed native pasture.
2. *Melilotus alba,* Sweet Melilot or White Melilot. This plant has been spoken highly of as a fodder at different times, but never seems to have taken on much in Australia. Two forms occur—an annual and a biennial form. It is looked on as a good honey-producing plant. We have had reports that it has withstood fairly dry conditions in Northern Queensland.

A "Wild Lucerne."

W.H.S. (Quilpie)—

The specimen is *Psoralea patens,* a native plant for which we have not heard a common name, other than "wild lucerne"—a name applied, however, to several leguminous plants in Queensland. The genus Psoralea contains about a dozen species, some of which are regarded as excellent fodder for stock. One of them is known as Urvine or Herb-vine in the Northern Territory. It is not a vine, but grows exactly like your species. Mr. A. J. Cotton once wrote us that this Northern Territory one was abundant on the flooded country from which the best bullocks come. We should say that Psoraleas are good fodder, but both the one you sent and the Northern Territory one referred to we have seen very frequently in quantities and left quite untouched by stock. It may be that stock have to acquire a liking for the plants.

Rural Topics

Meat for the Troops—How the Army Ration Originated.

The modern ration for soldiers only dates from the eighteenth century. The originator of the army ration was Frederick the Great, who realised the importance of proper feeding of the men who had to do the fighting. He organised a corps of foragers—known in the A.I.F. as "scroungers"—and their job was to go around the country gathering all available provisions. They also had to arrange for a "balanced ration"—that is the actual giving out of definite portions of various kinds of food to each soldier, either on a daily or weekly scale.

Much of Frederick's success as a general was because of his careful organisation for feeding his troops. Likewise, Wellington won many of his victories because he paid attention to the food supplies of his army. In fact, it was a boast of Wellington that many could lead troops, but that he alone could feed them.

Napoleon was, as everyone knows, the author of the famous phrase: "An army marches on its stomach." As a matter of fact, it was the experience gained in the Napoleonic wars which formed the basis of the modern system of meat packing and distribution.

The development of modern industrialism had not gone far, however, when Napoleon astounded the world by his ability not only to move troops with remarkable speed from one field of action to another, but also to obtain the necessary supplies even when far away from his base.

Washington had the same ideas in the American War of Independence. Nevertheless, organised supply of food to soldiers in the field was not on a really satisfactory basis in the United States until the World War. In the Civil War, the armies lived on the country around where they were fighting.

The development of freezing and canning and other forms of preservation—especially of meat—as was so near perfection in the last war, has made all the difference to the fighting soldier and those whose job it is to "keep the tucker up to him."

To feed the modern army—especially when a million men may be mobilised at the one time—requires tremendous organisation. The British Army authorities have had long experience in army equipment and supply, and that was why, no doubt, we only seemed to go short in the last war when the ration carrier was "knocked."

Meat has always been the foundation of the soldier's diet, but it has been provided by various means at different periods. In the old days—back to the time of Alexander the Great and Julius Caesar—farmers had to feed invading troops as well as fight them, but to-day meat for the troops comes out of a tin or a modern refrigerator. The great problem is to keep supplies up to them and that is how the producers of Queensland, as well as those of the rest of the Empire, will bring victory to the arms of the Allies.

Britain's War Time Agricultural Policy.

In all walks of life, war time conditions must differ from those of peace, although in various degrees and directions. It is inevitable that some must bend their energies to the more strenuous endeavour, and some may endure the greater sacrifices. That is what the farmers of the Old Country are already finding out after not much more than eight months of war.

But both strenuous endeavour and greater sacrifices are being accepted with characteristic cheerfulness by the British farmer who realises the futility of speculating on what might have been.

Britain's war time agricultural policy is based on a programme of ploughing up grass land, the sole aim of which is to reduce the Old Country's dependence on imported supplies of foods for both man and animal. The immediate object underlying this is to free shipping for other war time services. In all branches of farming, and particularly in regard to livestock, the British farmer is using his knowledge and experience to meet abnormal conditions. He has been asked for an effort and he is responding. Some have cheerfully adopted farming practice more or less strange to them. They are doing their utmost, forgetting any opinions about what might have been, and thinking only of what is.

Another Shearing Achievement.

Here is another remarkable shearing achievement, this time from New Zealand. On Waipari Station recently, a Maori shearer averaged 315 sheep a day for a six-day tally. This is claimed as a Hawkes Bay record for a six days' shearing tally. The same shearer also put up a Hawkes Bay record two seasons ago. His peak day's tally this season was 330 sheep.

A very fine effort, but we have seen no details as to the condition of the sheep or their fleeces and other circumstances in which it was accomplished.

Producer Gas Units on the Farm.

Because of the rise in the price of motor spirit, and a possible war time restriction, much interest is being taken by the man on the land in the possibilities of producer gas units for farm work. Here is some information of especial usefulness to all concerned.

Savings of more than 70 per cent. in fuel costs have been reported by New South Wales farmers who harvested wheat last season with producer gas-driven units.

This information has been given by the Producer Gas Committee appointed by the New South Wales Government. The committee visited the Parkes district recently and interviewed wheat farmers who are using tractors equipped with producer gas plants.

Evidence obtained shows that operating on full load a saving of over 70 per cent. in the fuel costs is made by using producer gas. This saving is usually sufficient to pay for the cost of installation within a period of one year.

On an average yield of about twelve bushels of wheat to the acre, it was found that the cost of tractors operating on liquid fuel was approximately fivepence a bushel; operating on charcoal the cost was a penny-ha'penny.

The number of tractors in New South Wales is about 13,000, approximately 100 of which are operated on producer gas. It is believed that there will be many conversions when the savings possible thereby are realised.

It is regarded as essential, however, that adequate supplies of fuel should be readily available and that producer units should be of an approved type. Furthermore, it is important, as with all other mechanical equipment, that there should be proper maintenance. Provided that the plant is efficient and proper care is given, engine wear would be less than is the case when other fuels are used.

A decided advantage of charcoal gas was that because of the low cost of power per acre, farmers were willing to give the workings to their soil necessary to ensure the highest yields.

It has been found during periods of low prices that many farmers using tractors try to reduce costs by neglecting to cultivate, with the result that yields do not come up to expectations. It is evident, therefore, that a cheap fuel results in more efficient farming.

As a matter of fact, charcoal and producer gas equipment for farming purposes should not be regarded either as experimental or for emergency purposes, but rather as a means worth adopting permanently in the interests of economical working of the farm.

An Outsize in Churns.

A giant butter churn which makes nearly 6,000 lb. of butter in one churning was an outstanding exhibit in the engineering court at the New Zealand Exhibition. The churn was made in New Zealand of kauri pine. Its capacity is 2½ tons of butter in a single churning of less than two hours.

"Breeding Standards."

Dr. John Hammond, of the animal breeding station at the Cambridge University School of Agriculture—he is remembered as a distinguished visitor to Queensland last year—describing his work recently, said that he had succeeded in breeding a "standard" rabbit which, no matter how it is mated within its breed, will produce the same sized litter with the same coloured eyes and fur, and with always the same proportion of males, and which show the same weight increases in the same length of time—if not troubled by disease. Now he hopes to supply the same principles to pig breeding for the purpose of trying to evolve a "standard" pig.

That would be "rationalising" the pig industry with a vengeance.

New Sheep-Blowfly Dressing.

abstract of [illegible] [illegible] much fuller than [illegible]

Graziers troubled with the blowfly problem will welcome a report of tests carried out at the McMaster Laboratory (New South Wales) which have given very satisfactory results.

The dressing known as C.B.E. contains boracic acid and camphor oil, and kills both maggots and flies which come in contact with it.

After trial under laboratory conditions, the dressing was subjected to a series of practical field tests under conditions favourable to fly-strike, especially crutch-strike, which covers about 90 per cent. of the affected ewes.

So that the tests might be of the utmost practical value, they were carried out on a number of properties in North-western New South Wales, not far below the Queensland border, and Southern and Central Queensland, covering a line running north and south for 600 miles where fly-strike is usually prevalent. The tests, which lasted from the autumn of 1938 to the autumn of last year, were made by graziers in collaboration with the science men.

Results, as a whole, are regarded as satisfactory. Of 140 sheep treated in one trial, only nine were restruck within fourteen days, most of these being on one property where an exceptionally severe fly attack was experienced.

Observations on the incidence of crutch-strike in the course of other field trials suggest that the restruck sheep might be of a highly susceptible type and very difficult to protect from restrike. To check this, a special trial was carried out at Walgett on sheep whose fly-strike record for the previous eighteen months was known. The results of this trial were similar to those on the property where nine sheep were restruck in a fortnight. All were very wrinkly sheep, the crutches of which were always damp, even when the wool was closely shorn, and the restrikes occurred on what was virtually bare, damp skin. In all these cases, the struck area outside the damp portion healed cleanly and quickly.

The new dressing was very easy to apply. It was found that all full-grown flies coming in contact with the dressing died instantly. Strike wounds were found to heal rapidly, and there was no evidence that the dressing had any harmful effect on either the skin or the wound. The wool remained free and did not become matted after treatment.

The dressing has not yet been available to graziers for large-scale tests under everyday conditions, as the war has held up imports of camphor oil. However, early shipments are due very soon. The dressing will then be manufactured locally, so that all sheepmen who are interested will be able to test it for themselves.

Thinking Out New Ideas for British Farmers.

The world is governed by ideas; and it is a very short-sighted farmer who is afraid of a new notion. A new war-time development in Britain is a sort of agricultural "C.I.D."—a "Clever Ideas Department," and it has the blessing of the British Minister for Agriculture. Its official title is "Special Inquiries," and it has a staff of four. Its business is to think of ideas which can be used to promote the food production campaign and to follow up any suggestions which may come from official sources and from unofficial sources.

At the present time this new department is working on a "waste not want not" programme, which has two objects—to see that nothing is wasted that could be profitably used on farms, and to see that the fullest possible use is made of the by-products of the farms on the farms.

Hundreds of suggestions which have been sent to the British Ministry of Agriculture since the war began have been referred to the new department. Few, however, have come from farmers.

"For the present," said one of the staff recently, "we are not anxious to get any more ideas from the general public. We have had one or two useful suggestions, but the rest have been either impracticable or just bunk. Ideas from practical farmers will always be welcomed, however." Some people, the official added, had offered to sell inventions.

Working in close touch with the new department is the Salvage Department of the Ministry of Supply. Between them they are investigating such matters as the conversion of town refuse into farm manure, the utilisation of factory wastes and by-products, and the disposal of "swill" from army camps for pig feeding.

Farm Notes

JUNE.

THE wheat planting season normally extends from April to July, with the main Darling Downs sowing during June. Well-prepared fallows should contain enough moisture to permit of sowings after light showers only, but on recently ploughed lands it will be necessary to await substantial rains or commence sowing dry when the surface soil has dried out sufficiently to avoid the malting of grain. Farmers unfamiliar with the characteristics of the different varieties of wheat should remember that, in general, early-maturing varieties should be sown late, and slow-maturing varieties sown early.

Of the varieties in general cultivation at present, Florence, Novo, and Seaspray are early maturing, while Currawa and Cleveland are slow maturing.

All others are classified as medium, early, or mid-season, with little difference in the number of days taken to mature under identical conditions.

All seed wheat should be treated for the prevention of ball smut, using copper carbonate or either of the mercury dusts "agrosan" or "ceresan."

Where dry conditions have prevented the earlier seasonal sowings of oats, barley, wheat, field peas, and other field crops, there is still time to profit by so doing, choosing early-maturing varieties which will make satisfactory growth before the normal warm, dry spring conditions commence.

With all fodder crops for grazing, greater value is obtained from a number of small paddocks which may be fed off in rotation.

Land intended for maize should now be ploughed to a depth of at least 9 inches, and allowed to lie in the rough until early spring, the action of frost and rain having a mellowing effect on the soil.

Paddocks set aside for the July and August planting of potatoes should also receive attention, as adequate preparation of land is one of the most important factors in successful agriculture.

Farmers desirous of destroying useless green timber or undergrowth with arsenic pentoxide are reminded that the April to July period is probably the most effective time for carrying out this work. Frill ringing and poisoning of trees with a 20 per cent. solution of arsenic pentoxide has proved very satisfactory, combined with the felling and swabbing of butts to destroy suckers and undergrowth. Shelter belts and shade trees should always be reserved when planning poisoning or ringbarking operations.

The winter is generally the best time to undertake the laborious work of ringbarking, clearing, fencing, and roadmaking.

Recently harvested maize grain should be allowed to dry out completely before being shelled, otherwise heating in the bags may occur.

Grain not required for immediate use or sale can be stored indefinitely at no great cost, other than the initial purchase of tanks and occasional fumigation to destroy weevils.

◆

EASY SCRUB-FEEDING.

Only people without thought cut down useful fodder trees; others merely lop off the top branches. Both way are wasteful, and regrowth is a matter of months, or even years. The most economical method is to flail the leaves off. By stripping the foliage in this way, the twigs remain to make new growth within a few weeks, when the process can be repeated.

Orchard Notes

JUNE.

THE COASTAL DISTRICTS.

IF the weather is dry, citrus orchards should be kept in a good state of tilth and winter green manure crops turned under. Old worn-out trees may be dug out and burnt. Custard apples will be ripening more slowly as the nights get colder. If the weather becomes very cold, or if immature fruit is sent South, the fruit is apt to turn black and become valueless. Grade custard apples carefully, and pack in cases holding a single layer of fruit only for the Southern markets.

The pineapple plantation should be shallow worked and kept free from weeds. The fruit takes longer to mature at this time of the year, consequently it may remain on the plant until partly coloured before gathering for the Southern markets.

Banana plantations also should be kept worked and free from weeds, especially if the weather is dry, as a severe check to the plants now may mean small fruit later on. Bananas should be allowed to become full before the fruit is cut. The necessity of proper handling, grading, and packing of the fruit should be kept in mind. Land intended for planting with bananas or pineapples during the spring should be prepared now.

Strawberries require constant attention, and unless there is a regular and abundant rainfall, they should be watered regularly. Where not already done, vineyards should be cleaned up ready for pruning. It is, however, too early to prune or to plant out new vineyards.

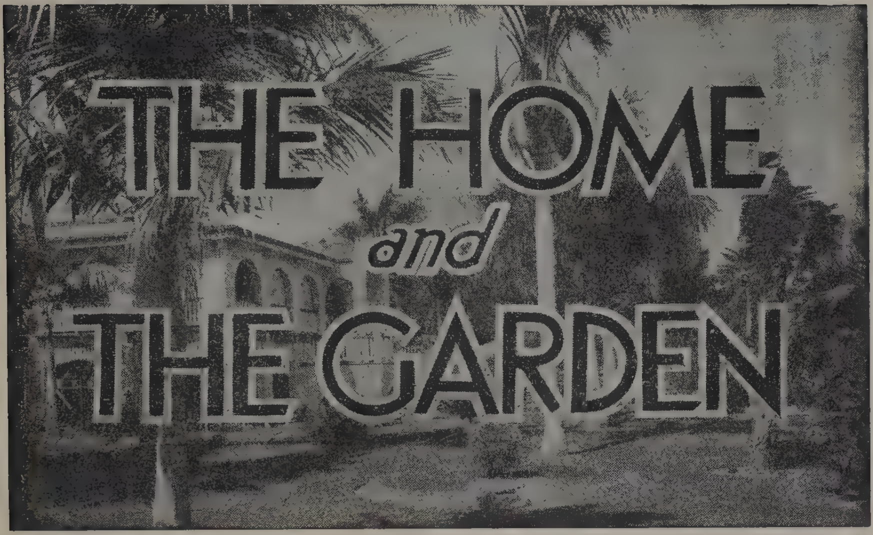
THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

ALL kinds of deciduous fruit trees are now ready for pruning, and this is the principal work of the month in the orchards of the Granite Belt. Thin out young trees properly, and cut them back hard. Many good trees are spoilt by insufficient or wrong pruning during the first three years. If in doubt as to the correct method of pruning consult the district instructor in fruit culture. In old orchards, do not have too much bearing wood; cut out severely, especially in the case of peaches. Planting may be commenced where the land is ready, as early-planted trees become well established before spring, and thus get a good start. When land is intended for planting this season, see that it is well prepared and well sweetened before the trees are put in, as young trees seldom make a good start when planted in sour or badly prepared land.

Slowly acting manures—such as bonedust, meatworks manure, or phosphates—may be applied now, as they are not liable to be washed out of the soil, and will be available for the use of the trees when they start growth in spring. Lime may also be applied where required. Badly drained land should be attended to, as no fruit trees will thrive with stagnant water lying round their roots.

On the Downs and Tableland all kinds of fruit trees may be pruned now, and vines also may be pruned in any district where there is no risk of late frosts. Prunings should be gathered and burnt, and the vineyards ploughed up and well worked to reduce the soil to a good state of tilth, so that should rain come it will absorb all that falls. The moisture can be kept in the soil by cultivation afterwards.

Citrus fruits will be at their best in the western districts. The trees should be watered if they show signs of distress; otherwise all that is necessary is to keep the surface of the land well worked. All main-crop lemons should have been picked by this time.



Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

CLOTHING BABY.

OUR talk this month is to be about baby's clothing, because in our work of keeping baby happy and comfortable and well, the manner in which he is clothed plays quite a big part, and one to which too little attention has been paid. We do not nowadays find babies clad in the long, heavily-trimmed robes and layers of tight binders beloved of our grandmothers, but there are still many mothers and mothers to be who need to learn what clothing baby should wear and why.

Purpose.

The real purpose of clothing is to protect the body from injury, heat, and cold, and baby should only wear enough clothes to keep him nicely warm. To pile layer after layer of superfluous clothing on a child is still a common fault amongst over-anxious mothers, who are afraid of the new baby "taking cold." The amount of clothing a baby should wear depends not on the season of the year, but on the temperature of the air, and the general condition of the child. It is sometimes possible to leave off some of baby's clothing on a particularly warm day in autumn or spring, and a cool change in summer may make it necessary to add a woolly. On the very hot days of our Queensland summer baby is often happiest clothed only in a singlet and napkin. A robust, vigorous child will require less clothing than one who is inactive, wasted, or ill. A premature or underweight baby requires special care in order to maintain his body temperature.

Comfort.

Baby's clothes, then, should be warm and light, and what weight there is should hang from the shoulders. Heavy clothing will tend to limit the child's movements and make him easily tired, and if too closely woven, will not allow free circulation of air. A baby may develop a skin rash from wearing too heavy or too many clothes. It is possible for loss of weight to occur, especially in small or weakly babies, from wearing garments that do not keep them warm. Coldness or blueness of the hands and feet and blueness of the lips indicate that the child is insufficiently clad. All garments should fit loosely. Tight elastics and strings should not be used. Plenty of room should be allowed at the armholes so that baby may use his arms freely and all seams should be well finished off to prevent chafing of the delicate skin. Too much material between the thighs should be avoided and waterproof material should not be used as it prevents evaporation of sweat and keeps the skin too moist. Lace edgings, especially round the neck, and too many bows and ribbons can very easily cause irritation and discomfort. For a number of reasons the best place to display pretty lace or embroidery is at the hem of babys frock, not on the bodice.

Economy.

The baby of to-day, especially in a climate like that of Queensland, needs but few garments. If these are made of good materials that wear and wash well, replacement becomes unnecessary. The most economical way of arranging a baby's wardrobe is to have the garments made in such a way that they can be easily adapted to fit either the new baby or the child of ten or twelve months. This is easily done by the addition of a few hand-made tucks in the shoulders, because the difference in the size is usually only in the width of the body and the length of the sleeves. As a baby gets older he needs shorter clothes, and the ones he wore at three weeks will probably be the right length at nine months. Hand-knitted garments cost very little and a number of books can be obtained which will help a mother with her knitting. Light wool or wool and cotton mixtures are more economical than flannelette which is made from cotton and ceases to be warm when the fleecy pile wears off. In addition, it is heavy and does not dry quickly. Of the summer materials fine linen or cotton voile wash and wear well and are cool, and silk is useful, but, of course, cannot be boiled, and is liable to discolour. The rayon materials are suitable, as they can be boiled, but they are inclined to crush easily, and do not usually wear as well as cottons.

Making and Laundering.

Although some washing has to be done every day with a baby in the home, we must aim at making the laundry work as light as possible. How many women when the day's work is finished have to spend the evening ironing little garments which crease almost as soon as they are put on again. Simple magyar patterns, easy to wash and quickly dried and ironed, are the best foundation for baby's layette. Even the mother unused to sewing can make them with very little trouble and with a few simple directions to follow can keep them looking "good as new" after washing. The first year of motherhood should be a joy not a time of unnecessary work and worry.

In our article next month we shall describe baby's outfit in detail.

You may obtain information on all matters concerning infant and child welfare by visiting the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred street, Fortitude Valley, N.1., Brisbane.

IN THE FARM KITCHEN.

CITRUS FRUIT JAMS.

Grapefruit Marmalade (1).

Grapefruit as required, to each pound allow 1½ pints of water and 1½ lb. of sugar.

Wipe and weigh the grapefruit and put it into a preserving pan with the water. Cover with plates so as to keep them under the water, bring to the boil, and boil gently for about one and a-quarter hours, until rinds are tender. Then leave until the next day. Unless using an enamel pan, it is advisable to turn the fruit and water into a basin when cool, as, if left in an aluminium pan for any length of time, it will discolour it. Take out the fruit and drain it, then cut into quarters and scrape out the pulp and soft pith. Rub this through a sieve; it will nearly all rub through with the exception of the pips. Measure the water in which the fruit was boiled, and, if it has been reduced to less than half, make up to half with water. Return it to the pan with the pulp and sugar, also the peel sliced thinly. Boil the pips in just a little water for about half an hour, then strain and add. Cook slowly until the sugar has dissolved, then bring to the boil and boil until it will jelly when tested, keeping it stirred and skimmed as required. It will probably take about one and a-half hours.

Grapefruit Marmalade (2).

Take 1 grapefruit, 1 lemon, 1 bitter orange, 1 sweet orange.

Wash and dry the grapefruit, oranges, and lemon. Peel as thinly as possible. Remove and throw away all white pith. Slice the fruit thinly, gathering up all pips into a small muslin bag, and catching any juice that happens to fall in the slicing. Put the pulp and finely-shredded peel into a basin, after measuring. Cover with three times the quantity of cold water and stand till next morning, covering with a cloth. Next morning put peel, pulp, water, and bag of pips into a preserving pan. Bring to the boil and boil two minutes. Return to the basin and cover. Repeat this process three days in succession, then throw out the bag of pips. Measure, add an equal quantity of sugar, and boil till the marmalade jellies when tested. Pot and cover.

Grapefruit Marmalade (3).

To 1 grapefruit, add 1 lemon and 1 orange, slice all very finely.

To every pint of pulp add 3 pints of water, soak all night, next day boil for fifteen minutes, then take off, leave again till next day; then add 1 lb. of sugar to each pint of pulp. Boil till syrup jells when tested.

Old English Style Marmalade.

Take 2 lb. Seville oranges, 4 pints water, 6 lb. sugar, juice 2 lemons.

Remove orange pips and place in a muslin bag. Tie with string. Squeeze juice from oranges and lemons into a saucepan. Shred and put orange-peel into the saucepan with the juice. Add water and bag of pips. Now add sugar. When sugar is dissolved, boil till a little sets when tested on a cold saucer. Leave standing in the saucepan for five minutes. Put into dry, warm jars and cover.

Seville Orange Marmalade.

Seville oranges as required. Allow 1 lemon to 9 oranges, allow 2 pints of water to 1 lb. of fruit.

Remove the peel from the oranges and lemons and cut it into fine shreds. Slice the fruit thinly, removing the pips. Cut the slices into four and put them into a basin with the peel and water to soak overnight. Next day turn the fruit into a preserving pan and boil until it is tender. Leave it until it is cold, then weigh it and allow an equal quantity of sugar. Let the sugar dissolve slowly, then bring the marmalade to the boil and boil it until it will jell when tested.

NOTE.—If the preserving pan is weighed before any cooking is done, the weight of the cooked fruit and water can be obtained quite easily.

Seville, Orange, and Lemon Marmalade.

Take 6 Seville oranges, 2 lemons, 2 sweet oranges; weigh them and allow 2 lb. sugar and 2 pints water to 1 lb. fruit.

Wipe the oranges and lemons and weigh them. Cut them into quarters and remove the pips. Put the pips into a basin with half a pint of cold water, and leave them to soak for a few hours; then strain off the water, and add it to the oranges and lemons. Slice the orange and lemon quarters very thinly, cutting pulp and rind together. Put them into a large pan and add water in proportion, less the half pint added from the pips. Leave the fruit to soak for about twenty-four hours, then boil it gently until the rinds are quite tender. Leave it soaking again until the next day, then add the sugar in proportion. Bring the marmalade slowly to the boil, and boil for about one hour and a-half or until it will jelly.

Orange Ginger Marmalade.

Take 6 lb. sweet oranges, 6 pints water, 6 lb. sugar, ¼ lb. lump ginger.

Wipe the oranges, peel them, and divide them into quarters, removing the pips, as you do so. Put the peel through the mincer, then put it into a preserving pan with the water and orange quarters. Bruise the ginger, tie it in muslin, and add it. Bring it to the boil, add the sugar and, when dissolved, boil the marmalade until it will jelly when cold, keeping it stirred and skimmed as required.

Orange and Rhubarb Marmalade.

Take 4 lb. of rhubarb (when cut up), 2 lb. sweet oranges, 1 lemon, 5 lb. sugar, 1 pint water.

Wipe the oranges and peel them. Put the peel in a pan with sufficient water to cover it well, and boil it gently until it is tender, adding more water if it is required. When the peel is ready, drain off the water and save it. Shred the peel finely. Remove the green leaves from the rhubarb, wipe the sticks and cut them into even-sized pieces. Cut up the oranges and remove the pips. Put the orange pulp into a preserving pan with the prepared rhubarb, the shredded peel, sugar, lemon juice, and grated lemon-rind, and a pint of the water in which the orange-peel was boiled. Cook the marmalade slowly until the sugar is dissolved, then bring it to the boil and boil it till it will jelly when cold. Pot and cover in the usual way.

Sweet Orange Jam.

Take 3 oranges, 3 lb. sugar, 3 pints water (boiling).

Cut the oranges very thinly, pour the boiling water over. Allow to stand till next day. Put the orange and liquid into a preserving pan and boil until the rind is tender, add the sugar, and boil again till it jells when tested.

Lemon Marmalade.

Take 12 lemons (3 lb. in weight), 7½ pints water, allow 1 lb. sugar to 1 lb. pulp.

Wipe the lemons and cut them in quarters.

Take out the pips and put them into a basin with 1 pint of the water and leave to soak for a few hours. Slice the lemon quarters very thinly. Put them into a preserving pan with the remainder of the water. Add also the strained water from the pips. Let this stand for about twenty-four hours. Then boil it gently for about one to one and a-half hours until the rinds are quite tender. Leave it to stand until next day, then weigh it and add the sugar in proportion. Bring to the boil, and boil for about one hour, or until it will jelly.

Lemon Jelly.

Take 12 lemons, 4 oranges, water, sugar.

Wash dry, and cut up the fruit roughly. Remove all the pips. Cover with ten pints of water (cold) and stand for twenty-four hours. Boil for two hours. Strain. Add sugar, allowing one pound of sugar to each pint of juice. Boil rapidly for ten minutes. Soak the pips in some of the water, and add the water to juice. Strain through muslin. Boil till the jelly sets when tested on a cold plate. Pot and cover at once.

Mandarin Cheese.

Take 2 lb. mandarins, 3 pints water, 3 lb. sugar, juice 2 lemons.

Wipe the mandarins and grate the skins lightly, then put the mandarins into a pan with the water, and boil them gently until tender. Drain them and cut them up in quarters and scrape out the pulp. Mince the pith in a mincer, then rub it through a sieve with the pulp. Boil the pips in about half a pint of water until it is reduced to a quarter of a pint. Strain this water into the water in which the mandarins were boiled, adding also the sieved pulp and pith, grated rinds, sugar, and lemon juice. Cook the mixture slowly until the sugar is dissolved, then bring it to the boil and boil it till it will jelly when cold.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

Table showing the Average Rainfall for the Month of March in the Agricultural Districts, together with Total Rainfall during 1940 and 1939, for Comparison.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	Mar.	No. of years' records.	Mar., 1940.	Mar., 1939.
North Coast.	In.		In.	In.
Atherton	8·82	39	29·09	19·79
Cairns	17·98	58	41·22	27·81
Cardwell	15·74	68	22·42	21·76
Cooktown ..	15·31	64	25·68	28·99
Herberton ..	7·86	54	13·70	21·65
Ingham	16·10	48	25·62	27·55
Innisfail	26·70	59	44·06	40·42
Mossman Mill ..	18·16	27	38·97	35·43
Townsville ..	5·71	23	5·27	6·50
Central Coast.				
Ayr	6·37	53	3·13	5·31
Bowen	5·79	69	4·08	3·60
Charters Towers ..	3·75	58	3·80	2·94
Mackay P.O. ..	12·21	69	16·28	14·08
Mackay Sugar Experiment Station	11·24	43	14·94	10·34
Proserpine ..	12·48	37	12·65	9·82
St. Lawrence ..	5·27	69	15·55	4·83
South Coast.				
Biggenden ..	3·99	41	6·17	3·12
Bundaberg ..	5·30	57	7·70	8·40
Brisbane	5·72	88	8·72	15·72
Caboolture ..	7·70	53	9·90	17·79
Childers	4·84	45	8·23	9·00
Crohamhurst ..	11·00	47	17·15	18·50
Esk	4·71	53	5·36	6·90
South Coast—contd.	In.		In.	In.
Gatton College ..	3·27	41	4·26	12·73
Gayndah	3·02	69	4·32	4·08
Gympie	6·20	70	6·81	7·14
Kilkivan	3·85	61	5·26	4·00
Maryborough ..	5·95	69	8·88	9·19
Nambour	9·53	44	11·74	18·36
Nanango	3·35	58	4·63	2·87
Rockhampton ..	4·42	69	5·68	8·31
Woodford ..	7·79	53	10·38	11·25
Central Highlands.				
Clermont ..	3·05	69	5·41	2·75
Gindie	2·61	41	..	3·65
Springsure ..	2·93	71	4·77	4·76
Darling Downs.				
Dalby	2·72	70	3·25	4·58
Emu Vale ..	2·38	44	2·69	7·28
Hermitage ..	2·08	33	..	..
Jimbour	2·58	52	3·32	2·91
Miles	2·70	55	3·73	3·80
Stanthorpe ..	2·62	67	2·57	5·00
Toowoomba ..	3·77	68	4·44	7·14
Warwick	2·53	75	3·60	8·61
Maranoa.				
Bungeworgorai ..	1·81	26	..	2·74
Roma	2·68	66	3·04	6·62

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—MARCH, 1940.

Compiled from Telegrahhic Reports.

Districts and Stations.	Mean Atmospheric Pressure. at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·83	86	73	93	17, 18, 19	68	7, 8	2,568	23
Herberton	..	76	64	85	17, 18, 20	56	15, 16	1,370	24
Rockhampton	29·98	85	71	93	19	66	1	568	15
Brisbane	30·08	81	67	94	20	61	28, 30	872	14
Darling Downs.									
Dalby	30·09	82	60	89	20, 29, 30	52	1, 28	325	8
Stanthorpe	..	76	56	87	28	44	27	257	6
Toowoomba	..	77	62	85	20	55	1, 9	444	8
Mid-Interior.									
Georgetown	29·87	89	69	98	20	60	8, 31	652	10
Longreach	29·97	89	66	96	20	55	1	18	3
Mitchell	30·06	83	61	88	6, 7	51	28	319	4
Western.									
Burketown	29·87	90	74	99	3	65	1	850	8
Boulia	..	93	69	100	19	57	1	..	..
Thargomindah ..	30·01	96	68	101	6, 7, 8	57	22	..	..

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

					MOONRISE.	
	May, 1940.		June, 1940.		May, 1940.	June. 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
1	6·18	5·20	6·37	5·3	a.m. 12·40	a.m. 1·53
2	6·18	5·19	6·37	5·3	1·31	2·47
3	6·19	5·19	6·38	5·3	2·21	3·39
4	6·19	5·18	6·38	5·3	3·11	4·32
5	6·20	5·17	6·38	5 3	4·3	5·27
6	6·21	5·17	6·39	5·3	4·53	6·22
7	6·21	5·16	6·39	5·3	5·48	7·17
8	6·22	5·15	6·39	5·3	6·41	8·9
9	6·22	5·15	6·40	5·2	7·34	8·59
10	6·23	5·14	6·40	5·2	8·28	9·47
11	6·23	5·13	6·40	5·2	9·22	10·32
12	6·24	5·13	6·41	5·2	10·13	11·15
13	6·25	5·12	6·41	5·2	11·1	11·56
14	6·25	5·11	6·41	5·2	11·48	p.m. 12·39
15	6·26	5·10	6·42	5·2	p.m. 12·32	1·21
16	6·26	5·10	6·42	5·3	1·15	2·5
17	6·27	5·9	6 42	5 3	1·58	2·53
18	6·28	5·9	6.42	5·3	2·40	3·43
19	6·28	5·8	6·43	5·3	3·24	4·36
20	6·29	5·8	6·43	5·4	4·11	5 32
21	6·30	5·7	6·43	5·4	5·2	6·27
22	6·30	5·7	6·43	5·4	5·53	7·24
23	6·31	5·6	6·44	5·4	6·48	8 20
24	6·32	5·6	6·44	5·5	7·45	9·13
25	6·32	5·6	6·44	5·5	8·42	10 5
26	6·33	5·5	6·44	5·5	9·38	10·56
27	6·33	5·5	6·44	5·5	10·31	11·54
28	6·34	5·5	6·45	5·6	11·20	..
29	6·35	5·4	6·45	5·6	..	a.m, 12·45
30	6·35	5·4	6·45	5·6	a.m. 12·12	1·31
31	6·36	5·3	..	..	1·3	..

Phases of the Moon, Occultations, &c.

7th	May.	●	New Moon	10 7 p.m.
15th	,,	☽	First Quarter	6 51 a.m.
21st	,,	○	Full Moon	11 33 p.m.
29th	,,	☾	Last Quarter	10 40 a.m.

Apogee, 3rd May, at 9.0 a.m.
Perigee, 19th May, at 5.0 a.m.

On the 5th the greatest and the smallest of the planets will be nearest each other, Jupiter rising at 5 o'clock and Mercury half an hour later. By the 10th, the latter will pass Saturn below the western horizon. All three planets will be near the position where the Vernal Equinox occurred in the Northern Hemisphere, 550 B.C., still called "The First Point of Aries," although it is now westward of this point, in Pisces.

At nightfall on the 10th Mars, the crescent Moon and Venus will form an attractive sight above the western horizon. Mars, the lowest, will set at 8 p.m., the Moon about 8.30, and Venus nearly 10 minutes later.

Venus, ever the fairest and most effulgent among the planets, will on the 20th attain its greatest brilliancy—this on account of being in that half of its elongated orbit where it is nearest the Earth, between us and the Sun. When it arrives at, or very near, the point where it is exactly in line with Sun and Earth its dark half is turned towards us but on either side it is more or less illumined. At this time we see it as a beautiful crescent, with a telescope.

Mercury rises at 4.43 a.m., 1 hr. 35 mins. before the Sun, and sets at 4.25 p.m., 55 min. before it on the 1st; on the 15th it rises at 5.48 p.m., 1 hr. 38 min. before the Sun, and sets at 4.44 p.m., 26 min. before it.

Venus rises at 9.51 a.m., 3 hrs. 33 min. after the Sun, and sets at 8.1 p.m., 2 hrs. 41 min. after it on the 1st; on the 15th it rises at 9.42 a.m., 3 hrs. 16 min. before the Sun, and sets at 7.52 p.m., 2 hrs. 42 min. before it.

Mars rises at 9.18 a.m. and sets at 7.42 p.m. on the 1st; on the 15th it rises at 9.4 a.m. and sets at 7.24 p.m.

Jupiter rises at 5.14 a.m. and sets at 4.40 p.m. on the 1st; on the 15th it rises at 5.5 a.m. and sets at 4.19 p.m.

Saturn rises at 5.53 a.m. and sets at 5.11 p.m. on the 1st; on the 15th it rises at 5.5 a.m. and sets at 4.19 p.m.

6th	June	●	New Moon	11 5 a.m.
13th	,,	☽	First Quarter	11 59 a.m.
20th	,,	○	Full Moon	9 2 a.m.
28th	,,	☾	Last Quarter	4 13 a.m.

Perigee, 15th June, at 1.0 a.m.
Apogee, 27th June, at 9.0 a.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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ANNUAL RATES OF SUBSCRIPTION.—Farmers, Graziers, Horticulturists, and Schools of Arts, **One Shilling,** members of Agricultural Societies, **Five Shillings,** including postage. General Public, **Ten Shillings,** including postage.

QUEENSLAND
AGRICULTURAL
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Event and Comment.

Action on the Farming Front.

WE realise now, if we ever did, the immense task which confronts the Allied armies and the Allied peoples. It is up to us who are far removed from the scene of war to do our utmost to assist Britain and France in their epic struggle. Our job is to increase the volume of our exports of foodstuffs and other essentials to the Motherland. As the Allied armies grow in strength and numbers, so does the demand for food and clothing for the fighting forces increase. Our butter, meat, wool, and other products keep our armies going. Action is the call to-day—action on the farming front, as well as on every other front, and by the strength of action we shall achieve victory.

Farmers Plough for Victory.

THE farmers of Britain have every reason to feel proud of their magnificent contribution to the war effort. Under very difficult conditions they have achieved a remarkably fine result. Nearly 2,000,000 more acres are now under the plough, and that is by no means the limit. The present aim is to keep going full steam ahead and make this year's contribution look puny in comparison with next year's production.

British farmers are not worrying about post-mortems on previous agricultural policy and past mistakes. War time is not the time, they say, for hitting below the belt, nor is it the time for taking any notice of the academic policies of armchair critics. To them it is the time for action, such as they have demonstrated in increasing their cropping areas by just on 2,000,000 acres. So far, they have done their job as efficiently as any of the other arms of national defence—not taking into account, of course, the splendid fighting forces in the firing line. Already there are signs that the farmer is regarded as a front line defender by the consuming public.

Given the necessary finance, machinery, implements, fertilizers, and prices, the farmers claim that they will do the job more effectively and more economically than any academic authority can do it for them.

There is something in all this for Queensland producers to think about. The big fact that emerges is that agricultural policy must be prepared, not on the basis of one year or two, but in terms of a generation. There must be one comprehensive policy to ensure confidence in rural industry and in its future development, without chopping and changing. Continuity should be the essence of all policy. The war has shown very clearly already that in the interests of the nation as a whole primary production must be soundly based.

We can take our hats off to the British farmers who at this moment are turning the last furrows in their two-more-million-acre drive for victory.

The Nation Must Be Fed.

"WE will deliver the goods" was the slogan of munition workers in the last war, when the whole nation had to be keyed up to exert itself to the utmost after a searching inquiry had revealed serious shortcomings in the equipment of our fighting services. The same slogan might very fittingly be adopted now by every essential industry, and especially by the food-producing industries, since on them has been laid a tremendous responsibility—the responsibility of feeding, not only the troops, but the entire nation. There is no doubt that the goods will be delivered, but the magnitude of the task is not overlooked. As the British Minister of Agriculture put it at a recent gathering of English farmers: "It is no less than changing the whole face of rural Britain, and that involves, not only producing the maximum amount of food both for humans and animals in the shortest possible time that nature will allow, but it also means getting back into production vast areas which have been allowed to go idle."

We may be sure that such an objective has not been lightly planned by the authorities in the Old Country, nor have its implications been lightly assessed. Another thing, too, is this: there is more than a suggestion in recent Government announcements in Great Britain that British farming is being raised to higher levels of efficiency to-day with something more lasting in view than satisfying war time needs.

All this has a special significance for the Australian producer. With Denmark, Holland, and other European countries in enemy occupation, immediate sources of food supply for Britain are now blocked. That means, of course, that Great Britain has to look elsewhere for the butter and bacon and other foodstuffs she got from those countries up to a month or so ago. Naturally, the Dominions will supply the wants of the Old Land to the last ounce required, with the single proviso that shipping space is available.

Farmers in this country, therefore, have thus, in addition to a natural obligation, a great opportunity for widening the demand for their exportable commodities. Greater intensity of production, greater efficiency in production, readiness to recognise a great opportunity and willingness to develop it are the demands of the moment. Furthermore, quality standards have to be raised to the limit so that we may hold our markets when the war is over.

In the meantime, the Nation must be fed, and the farmers of this country, as well as those of other Dominions of the British Commonwealth, will see that "the tucker is kept up to it."

Effect of the War on Rural Industry.

THOSE who have given some study to the effect of the war on the land industries in Australia consider that its effect in the main will be to force rapid reorganisation, higher efficiency standards, and better standards generally. Obviously, now is the time to get busy on the spade work of methods of improving our standards in the market as well as in the paddock. All these matters will be of tremendous importance after the war, and now is the time to tackle the inevitable problems which will face us when the war is over. Marketing both at home and abroad will certainly be one of the most important of post-war problems.

Young Farmers' Clubs—National Recognition.

THE young farmers' club movement in Britain has become of such importance in war-time Britain that it has received national recognition. The powers that be have become aware that this movement can offset the drift from the land to the cities, can provide intelligent leadership for willing but unskilled young labour, and can constitute a clearing house for all kinds of rural activities.

One especial way in which these young farmers' clubs have been helping in the changed conditions is in regard to town children evacuated to country districts. Those youngsters with a liking for farm work have been made members of clubs, and many boys have thus been helped to a closer knowledge of farming. In fact, it is no uncommon sight to see boys as young as thirteen years of age driving heavy farm tractors and so doing their bit in ploughing for victory.

Tobacco Seed-Bed Fertilizer Experiments.

L. F. MANDELSON, B.Sc.Agr., Research Officer.

ATTENTION has been focussed on the importance of fertilizer mixtures for tobacco seed-beds in recent years in Queensland by the discovery that one important source of seed-bed failure was the use of excessive quantities of organic nitrogen. This physiological trouble, known locally as yellow patch, was fully discussed (4) in the "Queensland Agricultural Journal," in September, 1939. Therein it was indicated that the trouble was associated with the use of large quantities of organic nitrogen, such as dried blood or animal manures, on tobacco seed-beds, and was probably caused by the accumulation of free ammonia in the soil coming in contact with the roots of young tobacco seedlings. To avoid this trouble tobacco-growers were advised to use only nitrate of soda as a source of nitrogen in mixed fertilizers for seed-beds, and it was suggested that a mixture containing by weight two parts of nitrate of soda, four parts of superphosphate, and one part of sulphate of potash, applied at the rate of 1¾ oz. per square yard, should be used. This fertilizer treatment was recommended since it had been fully demonstrated that it could be satisfactorily used under Queensland conditions, and, furthermore, it was very similar to a standard recommendation made for tobacco seed-beds in South Africa (7).

A review of available literature on tobacco seed-bed fertilizer mixtures, made during the course of the yellow patch investigation referred to above, indicated that information on this subject was scanty and that there was a considerable divergence in recommendations. It appeared, therefore, that while a provisional recommendation could be made with confidence which would eliminate the incidence of yellow patch and result in satisfactory seedling growth, further investigation to evolve a more efficient fertilizer mixture might be profitably undertaken. Seed-bed fertilizer experiments were consequently carried out during the 1939-40 season for this purpose, and the object of this article is to discuss such work and to make a recommendation for a tobacco seed-bed fertilizer mixture based on the results obtained.

Seed-bed Fertilizer Mixtures.

Before discussing this experimental work on seed-bed fertilizers it will be of interest to review recommendations which have been made in other tobacco-growing countries for fertilizer mixtures for seed-beds.

In 1938 a conference of tobacco specialists in the United States of America (8) recommended a 4-8-3 mixture for seed-beds. It was stressed that materials for this mixture should be practically free of chlorides, and it was suggested that the addition of 1 per cent. available magnesia would be beneficial in certain cases. No mention of a rate of application, however, was made. More specific recommendations have been made from time to time by authorities in some of the American tobacco-growing states. These might be briefly summarised as follows:—

Virginia (1935) (1) ..	1½ lb. to 2 lb. per square yard of a 4-8-3 mixture.
North Carolina (1933) (5)	200 lb. of a 5-8-3 mixture for each 100 square yards.
South Carolina (1927) (2)	100 to 150 lb. of either a 4-8-3 or a 4-8-4 mixture for each 100 square yards.
Georgia (1928) (3) ..	2 to 3 lb. per square yard of a 5-8-6 mixture.

The above range of recommendations covers applications which would supply to each square yard of seed-bed quantities of nitrogen varying from 0·64 oz. to 2·4 oz., phosphoric acid from 1·28 oz. to 3·84 oz., and potash from 0·48 oz. to 2·88 oz. These limits are equivalent to 4·1 oz. and 15·4 oz. of nitrate of soda, 6·2 oz. and 18·7 oz. of superphosphate, and 1·0 and 6·0 oz. of sulphate of potash respectively. Obviously such variations are extremely great.

In Canada (6) a standing committee of tobacco specialists recommended the use of 125 lb. of a 2-10-8 mixture for each 1,000 square feet of seed-bed for the 1940 season. This fertilizer would supply 0·36 oz. of nitrogen, 1·8 oz. of phosphoric acid, and 1·4 oz. of potash per square yard.

Finally, in South Africa (7) it has been recommended that ½ lb. nitrate of soda, 1 lb. of superphosphate, and ½ lb. of sulphate of potash be applied to 20 square yards of seed-bed. This is approximately equivalent to a 4-10-12 formula, and would supply 0·06 oz. of nitrogen, 0·16 oz. of phosphoric acid, and 0·2 oz. of potash per square yard. It is much the same as the recommendation made in 1939 for use in Queensland, which would supply 0·08 oz. of nitrogen, 0·21 oz. of phosphoric acid, and 0·12 oz. of potash per square yard.

These various recommendations indicate that a considerable discrepancy exists as to the quantity of plant food material which it is believed should be applied for optimum seedling growth on typical flue-cured tobacco soils, which are usually fairly poor. They suggest, furthermore, that some of the rates of application specified might be unduly high.

Design of Seed-bed Fertilizer Experiments.

Two experiments to investigate seed-bed fertilizers were established at Dimbulah, in North Queensland, during the 1939-40 season. Each had the same design with a different randomisation of plot treatments. The object of these experiments was to ascertain the optimum quantities of nitrogen, phosphoric acid, and potash for seedling growth. The materials and quantities investigated were as follows:—

Nitrogen, as nitrate of soda, applied at the rate of—

(1) ½ oz. per square yard (0·08 oz. N).
or (2) 4 oz. " " " (0·64 oz. N).

Phosphoric Acid, as superphosphate, applied at the rate of—

(1) Nil.
(2) 1 oz. per square yard ($0{\cdot}2$ oz. P_2O_5).
(3) 2 oz. " " " ($0{\cdot}4$ oz. P_2O_5).
(4) 3 oz. " " " ($0{\cdot}6$ oz. P_2O_5).

Potash, as sulphate of potash, applied at the rate of—

(1) Nil.
(2) ¼ oz. per square yard ($0{\cdot}12$ oz. K_2O).
(3) ½ oz. " " " ($0{\cdot}24$ oz. K_2O).
(4) ¾ oz. " " " ($0{\cdot}36$ oz. K_2O).

The treatments were arranged in randomised blocks of sixteen plots, certain of the higher order interactions being partially confounded. Each plot was 1 square yard in area, and the ninety-six plots of an experiment were distributed in three seed-beds 72 feet long by 4 feet wide.

To ensure uniform distribution of materials the ingredients for each plot treatment were mixed with varying quantities of washed sand to make the total volume of the mixture up to a uniform bulk.

Initial Seed-bed Fertilizer Experiment.

The first of these seed-bed experiments was established on a grey alluvial soil on 17th September, 1939. This soil, while slightly more fertile than the average North Queensland sandy soils, could still be considered poor. On analysis it was found that the top 12 inches of soil contained 0·04 per cent. total nitrogen, and 0·004 per cent. and 0·008 per cent., respectively, of phosphoric acid and potash soluble in 1 per cent. citric acid.

Although the precaution was taken to partially sterilize the soil with heat, by burning the inner portion of termite nests over the beds, unfortunately an uneven stand of seedlings was obtained. This partial failure, apparently caused by nematode infestation and possibly other factors, complicated the interpretation of the data collected. Nevertheless, on the 6th October, nineteen days after the emergence of seedlings was general, observations for each plot were recorded in regard to seedling size and vigour, irrespective of stand of plants. For this purpose plots were classified from 1 to 6 to indicate the average size of seedlings in each plot.

When the data obtained in this manner was statistically analysed, highly significant differences were noted between the respective rates of growth of seedlings receiving different applications of nitrogen and phosphoric acid. With the higher rate of application, or level of nitrogen, plants were significantly larger than with the lower level. On the average, the third level of phosphoric acid produced the largest plants, and this result significantly exceeded that obtained where the two lower levels were applied. No significant differences resulted from the potash treatments investigated, although growth was slightly better with the third level.

Hence it can be concluded that this experiment indicated that the best seedling growth occurred when nitrate of soda was applied at the rate of 4 oz. per square yard and superphosphate at the rate of 2 oz. per square yard, and that apparently varying applications of sulphate of potash did not significantly influence growth. Owing to the generally uneven stand, due to disease factors, observations on plant populations of plots would have been misleading and consequently were omitted.

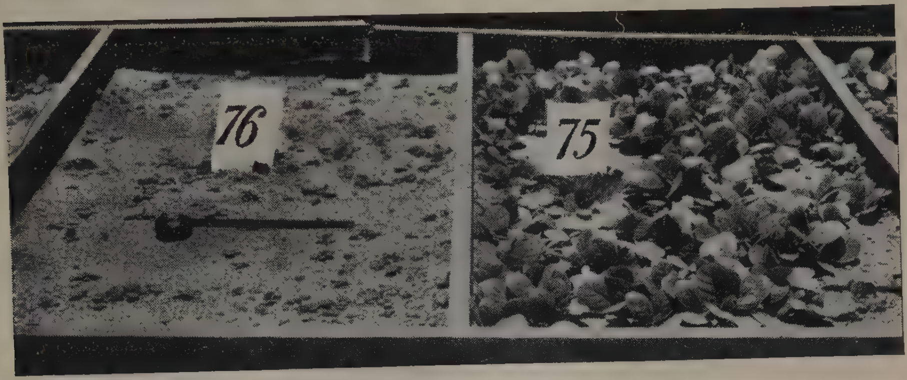

Plate 134.

SECOND SEED-BED FERTILIZER EXPERIMENT.—Two plots illustrating the striking increase in growth produced by superphosphate. Plot No. 76 received only ½ oz. of nitrate of soda per square yard, whereas Plot No. 75 received 2 oz. of superphosphate in addition to ½ oz. of nitrate of soda per square yard. Potash was omitted in both cases.

For statistical analysis Plot No. 76 was graded as 3 and Plot No. 75 as 12 out of a possible score of 20.

Second Seed-bed Fertilizer Experiment.

On 3rd November a second seed-bed experiment was established on a site close to the initial experiment and on a similar soil type. On 3rd December, twenty-three days after seedlings had emerged, contrasts between plots receiving different fertilizer treatments were striking (Plate 134), and at that time data was recorded to indicate seedling growth and vigour. The average size of seedlings in each plot was classified by numbers ranging from 1 to 20. Five days later an attempt was made to record the average root development of a few plants taken at random from each plot. Root size was indicated by the allocation of numbers from 1 to 10. On the same date an estimate of plot populations was also recorded.

A statistical analysis of seedling growth data indicated that a significant increase in the size of plants resulted from the application of the higher level of nitrogen, as in the previous experiment. Differences in growth response, when various levels of phosphoric acid were applied, were very highly significant. Actually, the best result was obtained with the fourth or highest level of phosphoric acid (Plate 135), although the difference in growth response between this and the third level was not significant. Both the third and fourth levels, however, gave significantly better results than the two lower levels, and it would appear that the optimum application would be one greater than the third and less than the fourth level, or between 2 oz. and 3 oz. of superphosphate per square yard.

On the average, potash did not produce significant differences in growth, although there was evidence of a significant interaction with phosphoric acid, as will be discussed later. Actually, with the various

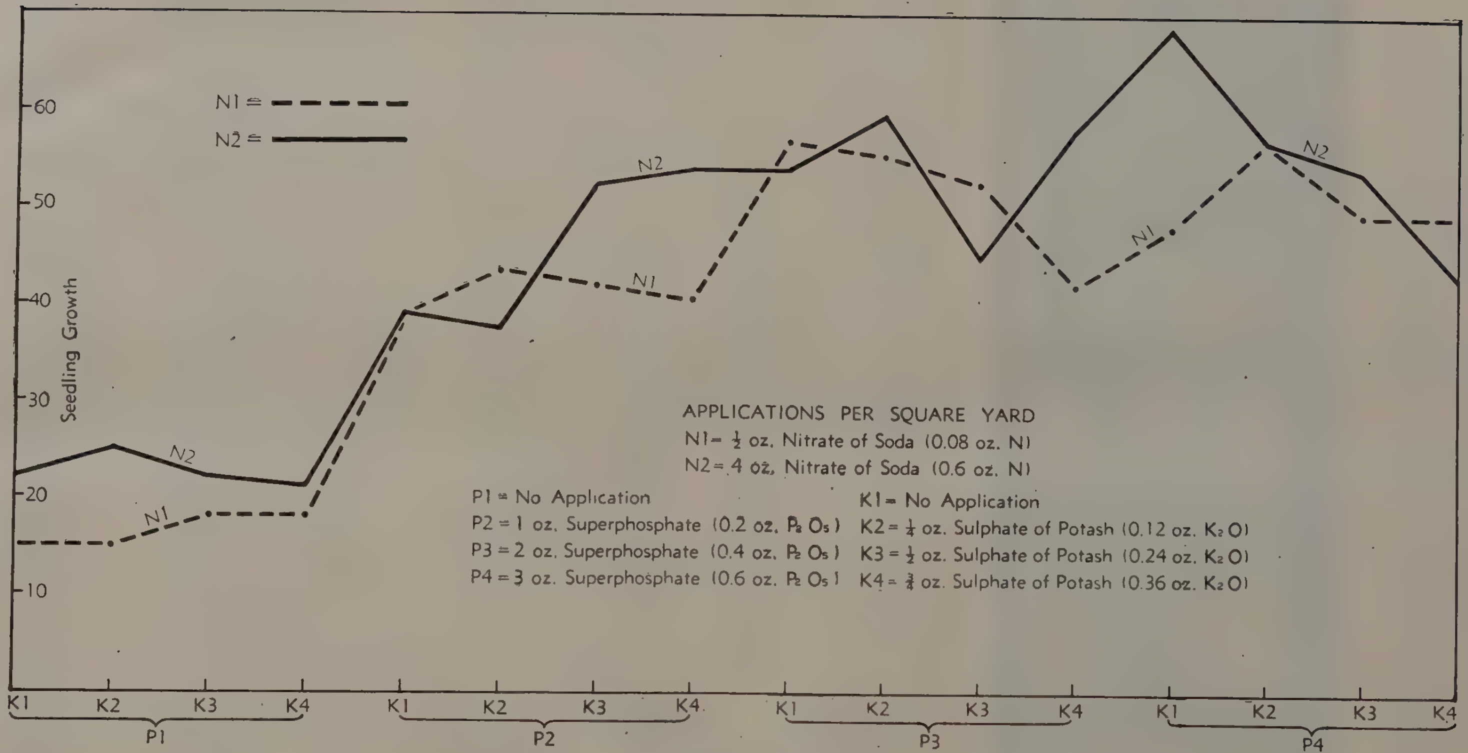

Plate 135.

GRAPH SHOWING AVERAGE SEEDLING GROWTH.—Size of plants resulting from the application of either ½ oz. or 4 oz. of nitrate of soda per square yard when applied with increasing quantities of superphosphate and sulphate of potash. Data obtained from the average of three replications of each treatment.

levels of nitrogen and phosphoric acid investigated, the best result was obtained with the second level of potash (Plate 136), which was equivalent to ¼ oz. of sulphate of potash per square yard.

It will be noted that these results are substantially the same as, and tend to confirm, those obtained from the initial experiment. They indicate that, of the quantities of fertilizer ingredients investigated, optimum seedling growth was obtained from applications of 4 oz. per square yard of nitrate of soda and between 2 oz. and 3 oz. per square yard of superphosphate, and that increasing applications of potash, on the average, did not enhance growth.

The effect of phosphoric acid on both plot populations and root development was also found to be highly significant. The best result was obtained with the third level, equivalent to 2 oz. of superphosphate per square yard. Applications in excess of this amount did not result in any beneficial effect as regards these two factors. Neither nitrogen nor potash significantly influenced seedling population or root development. Consequently, it would appear that treatments resulting in optimum seedling growth would not adversely affect either stand or root development of plants.

The Influence of Potash on Seedling Growth.

Although the growth of seedlings was not enhanced to a significant extent by the application of potash, some apparently beneficial effect was noted when potash was applied with relatively light applications of phosphoric acid. On the other hand, it was found that potash exerted a definitely adverse influence on otherwise beneficial effects caused by the application of increasing quantities of phosphoric acid. This was particularly noticeable with the heaviest application of phosphoric acid when the heavier applications of potash were also made.

A graph (Plate 136), showing the average seedling growth response to phosphoric acid at various levels of potash, when results with both levels of nitrogen are combined, illustrates this tendency. The line K1 of the graph, where no potash at all was applied, suggests the normal growth curve whch would be obtained by applying increasing quantities of phosphoric acid, and the lines K2, K3, and K4 show growth curves obtained by the application of increasing quantities of potash. It will be seen that, at the second level of phosphoric acid (P2), increasing quantities of potash apparently resulted in enhanced growth, although increases in growth, due to these applications, were not sufficiently great to be considered significant. If potash did not exert any depressing effect on seedling growth, it might be expected that these curves, K2, K3, and K4, would tend to proceed parallel to K1 as increasing quantities of phosphoric acid were applied. However, it will be noted that this did not occur, and, at the third level of phosphoric acid (P3), the two higher levels of potash resulted in poorer growth than did the two lower levels. Of these, K2, representing the lowest application of potash actually investigated, gave the optimum response. At the highest level of phosphoric acid (P4) seedling growth appears to be progressively poorer as applications of potash are increased. This is particularly obvious when the results of the two lower levels are compared with those of the two higher levels.

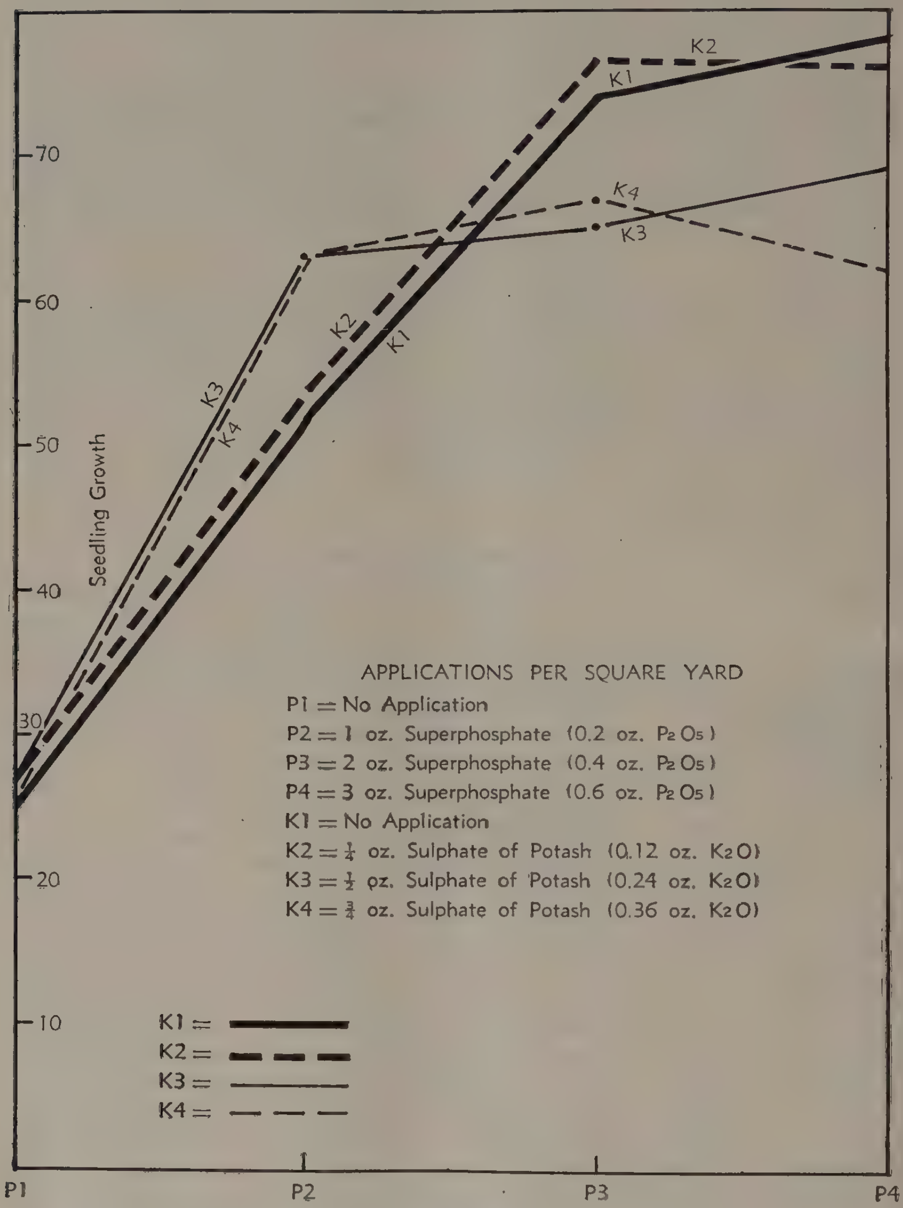

Plate 136.

GRAPH SHOWING AVERAGE SEEDLING GROWTH RESPONSE TO SUPERPHOSPHATE AT VARIOUS LEVELS OF SULPHATE OF POTASH.—Note the depressing influence of sulphate of potash with high applications of superphosphate, as shown by the relatively greater flattening out of the curves K3 and K4 as compared with K1 and K2.

The depressing effect of relatively heavy applications of potash in association with heavy applications of phosphoric acid, as illustrated above, was substantiated by the careful statistical analysis of recorded data. It is concluded, therefore, that, while the addition of some potash to seed-bed fertilizers might be desirable for normal plant growth, caution must be exercised as to the quantity used, particularly when relatively heavy applications of phosphoric acid are made.

Recommendation for an Improved Seed-bed Fertilizer.

The results of the experiments discussed above suggest that the provisional fertilizer mixture recommended during the 1939 season could be improved by increasing both its nitrogen and phosphoric acid content so as to supply the equivalent of about 4 oz. of nitrate of soda and 2½ oz. of superphosphate per square yard. Although no significant increases in growth resulted from applications of potash, and under some conditions relatively large quantities were even found to be detrimental, it is considered advisable, nevertheless, to retain the original recommendation of ¼ oz. sulphate of potash per square yard in seed-bed fertilizers. The object in so doing is to supply sufficient of this important plant food material for normal growth, as potash, as well as other nutrients, might be deficient on some of the poor sandy soils frequently used for seed-beds in North Queensland. Incidentally, recent research in Canada (9) has demonstrated that the presence of potash for seedling growth may improve the leaf quality of mature plants by increasing body in the cured leaf. For the same reason about 1 per cent. of soluble magnesia, as recommended by American authorities, should be desirable.

In designing a mixed fertilizer to embody these various factors, it also appeared desirable that its bulk should be such that, with a convenient weight of application, such as about 5 lb. per 100 square feet, it would supply the desired quantities of ingredients per unit area of seed-bed. To do this, and yet avoid the use of an inert "filler" material, it was considered that cotton-seed meal might be used as a secondary source of nitrogen to supply 10 per cent. of the bulk of the mixture. This material would only supply 0·06 oz. of nitrogen per square yard, if the mixture were applied as recommended, and hence there should be no danger of the yellow patch disease being induced by its inclusion. On the other hand, it is considered that this ingredient should be beneficial in improving the physical texture of the proposed mixture, and also in possibly adding small quantities of minor elements which might otherwise be lacking in poor sandy soils.

Based on the above considerations, the following fertilizer mixture, designed to contain 8·28 per cent. nitrogen, 6·82 per cent. phosphoric acid, 1·62 per cent. potash, and 1·08 per cent. soluble magnesia, is suggested for tobacco seed-beds:—

	lb.
Nitrate of soda	48
Cotton-seed meal	10
Superphosphate	32
Sulphate of potash	3
Magnesium sulphate	7
Total	100

It is recommended that this mixture be applied at the rate of approximately ½ lb. per square yard or, more precisely, at the rate of 5¼ lb. per 100 square feet of seed-bed, since this would be exactly equivalent to 4 oz. of nitrate of soda, 2½ oz. of superphosphate, and ¼ oz. of sulphate of potash per square yard.

Fertilizer manufacturers will prepare this mixture ready for use in 10½ lb. lots, which is the exact quantity required for a seed-bed 50 feet by 4 feet (i.e., 200 square feet). This source of supply should be the most convenient for an accurate application of the fertilizer. If, however, growers prefer to make it up for themselves they may mix according to the above formula.

Summary.

To investigate possible improvements for a provisional seed-bed fertilizer mixture recommended for the control of the yellow patch disease of tobacco seedlings, two experiments were established at Dimbulah during the 1939-40 season.

These experiments were designed to investigate the effect of (1) nitrate of soda applied at the rate of either ½ oz. or 4 oz. per square yard, (2) superphosphate applied at the rate of 0 oz., 1 oz., 2 oz., or 3 oz. per square yard, and (3) sulphate of potash at the rates of 0 oz., ¼ oz., ½ oz., or ¾ oz. per square yard.

A significant increase in growth resulted from the application of 4 oz. of nitrate of soda per square yard in both experiments.

Superphosphate applied at the rate of 2 oz. per square yard in the first experiment, and at the rate of 3 oz. per square yard in the second experiment, resulted in optimum growth responses. When applied at the rate of 2 oz. per square yard in the second experiment superphosphate also significantly increased both seedling root development and plant population per unit area, but neither nitrogen nor potash had any such effect.

Sulphate of potash, on the average, did not significantly enhance seedling growth in either experiment. When applied in relatively heavy applications, associated with relatively heavy applications of superphosphate, it had a depressing effect on growth.

A seed-bed fertilizer mixture is recommended based mainly on the results of these experiments. It consists of 48 per cent. nitrate of soda, 10 per cent. cotton-seed meal, 32 per cent. superphosphate, 3 per cent. sulphate of potash, and 7 per cent. magnesium sulphate, and contains 8·28 per cent. nitrogen, 6·82 per cent. phosphoric acid, 1·62 per cent. potash, and 1·08 per cent. soluble magnesia. When applied at the rate of 5¼ lb. per 100 square feet it supplies the equivalent of 4 oz. of nitrate of soda, 2½ oz. of superphosphate, and ¼ oz. of sulphate of potash to each square yard of seed-bed.

Acknowledgments.

The author wishes to gratefully acknowledge the helpful co-operation of Mr. P. McGovern, Assistant (Biometry), of this Department, for the statistical analyses of experimental data, and of Mr. H. McNee, Field Assistant, also of this Department, for the establishment of the seed-bed experiments at Dimbulah and for the compilation of seedling counts, as well as the Agricultural Chemist's Branch for the chemical analysis of seed-bed soil.

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THE QUEENSLAND AGRICULTURAL AND PASTORAL HANDBOOK.

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Urochloa Grass.

L. S. SMITH, B.Sc., Assistant to Research Officer.

[Urochloa Grass*, which is spreading on the Darling Downs, seems to be a valuable chance introduction. Several specimens of this grass have been received by the Department of Agriculture and Stock with the report that it was smothering Mint Weed† and had possibilities in the control of this pest. These notes may help farmers to recognise the grass should it make its appearance on their properties.—ED.]

Common and Botanical Names.

THE only common name so far known to be applied to this species is Wild Millet, but that name is considered unsuitable as it is already applied to some other common grasses, chiefly to species of Echinochloa. Since the generic name is short, and as this is the only member of the genus definitely established in Queensland, either native or naturalised, it seems appropriate to employ it as the common name and to refer to this species as Urochloa Grass.

"Urochloa" is derived from the two Greek words "ura" (a tail) and "chloa" (a grass). Although the application of the combination "tailed grass" is somewhat doubtful, it may refer to the bristle-like process on the tip of the fertile floret within the "seed" or spikelet. "Panicoides" is derived from "panicum," the Latin name for Millet and also the botanical name of a genus of grasses, and "eidos," a Greek word meaning resemblance. The specific name, therefore, refers to the resemblance of the grass to some members of the genus Panicum as the latter was understood when this species was described.

Popular Description.

A loosely tufted annual grass from ½ to 2 feet high with sparsely branched erect stems, which often spread slightly in the lower portion before becoming erect and sometimes root at a few of the lower notches. The leaves are a rich green colour, soft to the feel, conspicuously hairy, commonly 2 to 4 though sometimes up to 8 inches long, and ¼ to ⅓ of an inch wide. The seed head consists of from two to six branches which each bear two rather densely packed rows of paler green seeds, which overlap for about half their length. The branches of the seed head are erect when they first appear and project from the upper leaves, but towards maturity the seed head becomes stalked and the branches tend to spread.

The seeds are 3/16 of an inch long and are interspersed with a few rather long, fine hairs. The outermost face is furrowed lengthwise, and there are three veins in the groove, while at the base there is a very small scale 1/16 of an inch long. The back or innermost face of the seed is rounded.

Leafy Panic Grass‡ and some of its allies may at first sight be confused with Urochloa Grass, but the difference in the size of the seed and its looser arrangement on the branches of the seed head serve to distinguish these grasses. Another more fundamental difference is that whereas Urochloa Grass has the face of the seed with the very small scale at the base turned outwards, the Leafy Panic grasses have the rounded back of the seed outermost and the face with the scale at the base turned inwards.

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* *Urochloa panicoides* Beauv.

† *Salvia reflexa* Hornem.

‡ *Brachiaria foliosa.*

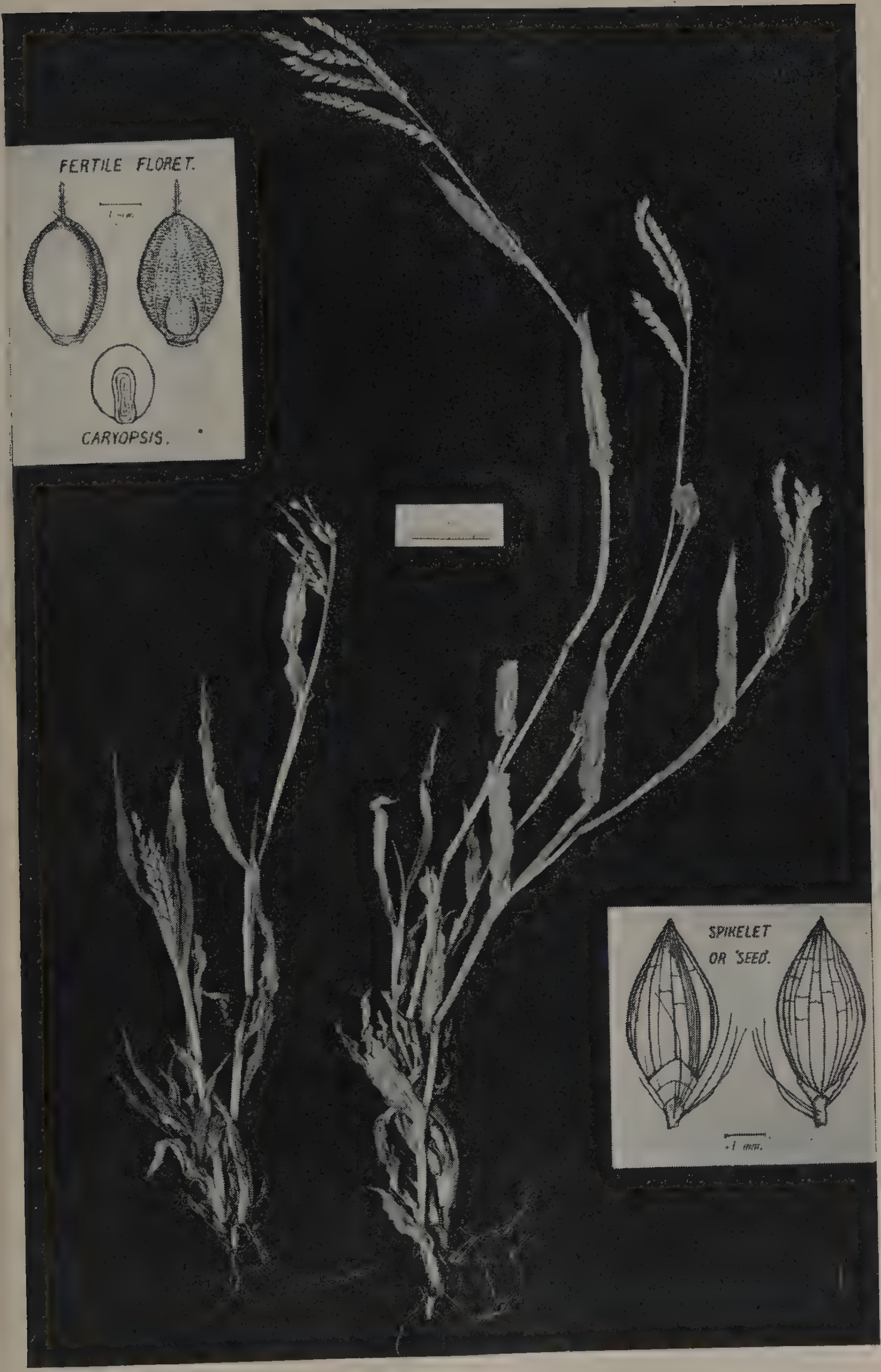
FERTILE FLORET.
1 mm.
CARYOPSIS.
SPIKELET OR 'SEED'.
1 mm.

Plate 137.

UROCHLOA.—A grass of potential economic importance.

Botanical Description.

More or less loosely tufted annual, 15-45 mm. (sometimes more) high; culms erect, oblique or geniculate ascending and sometimes rooting at the lower nodes, up to 2·5 mm. diameter, 4-8 (rarely more) noded, sparingly branched at the lower nodes; internodes longer upwards, several of the lower sometimes about 5 mm. long and appearing shortly rhizomatous, intermediate ones typically shortly exserted, striate and with one longitudinal furrow, like the peduncle ± densely and spreadingly pilose with tubercle-based hairs except towards the base, rarely almost glabrous. Leaf sheaths keeled, striate, somewhat loose and often falling away in their upper part, from spreadingly tubercle-based hairy above or only towards the margins to pilose throughout; nodes pubescent or villous; ligule a densely ciliate rim 1-1·5 mm. long; blades soft, flat, ± densely and spreadingly pilose with tubercle-based hairs, acute at the apex, commonly linear to linear-lanceolate and semiamplexicaule at the base, 2-8 cm. long, 3-8 mm. wide, but sometimes narrowed gradually towards the base and up to 20 cm. long, primary lateral nerves 4-5 on each side of the midrib, margins undulate and crisped and often whitish. Inflorescence of 2-6 subsessile or pedunculate (the peduncles up to 5 mm.), secund, spiciform, erect or slightly spreading racemes; common axis compressed, pubescent at least on the angles, 0·5-6 cm. long; racemes moderately dense, simple, 2-seriate, 1-6 cm. long, mostly solitary rarely 2 approximate; rhachis straight or slightly wavy, ciliate on the margins, typically pubescent at the base, about 1·25 mm. wide, flat with a slender median longitudinal ridge beneath, internodes 1·2 mm. long; pedicels short stout oblique stumps broadening towards the apex, solitary, bearing several long white hairs, hairs 1-4 mm. long; spikelets in each series imbricate for about ½ their length, oblong elliptic, elliptic, or ovate elliptic, acuminate, acute at the apex, 4-5 mm. long, 1·6-2·1 mm. wide, glabrous. Glumes very unequal; the lower abaxial, broadly ovate, obtuse, clasping at the base, 1-1·5 mm. long, sub-5-nerved; the upper equalling the spikelet in shape and size, 9-13 nerved, sparsely reticulate above the middle. Lower floret sterile or male and then the anthers slightly larger than those of the fertile floret; lemma reaching the tip of the spikelet, typically longitudinally furrowed, 5-7 nerved, slightly reticulate in the upper part; palea practically as long as the lemma, 2-nerved, keeled at and winged on the nerves, inflexed flaps well developed and overlapping. Upper floret hermaphrodite, broadly elliptic, including the 0·8-1 mm. long mucro, 3·5-4·1 mm. long; lemma crustaceous, obtuse and ± scabrous pubescent at the apex, 5-7 nerved, transversely rugose, the margins shortly inrolled, after flowering a pair of depressed globular appendages frequently develop towards the margin at the base of the mucro, mucro sparsely and spreadingly hairy; palea 2-nerved, punctate or very finely rugose; lodicules 2, broadly cuneate, about 0·4 mm. long; stamens 3, anthers 0·8-1 mm. long; styles 2, free, stigmas plumose, blackish; ovary about 0·75 mm. long; mature caryopsis, pale greenish yellow, broadly ovate- or elliptic-oblong, strongly compressed, 2·0-2·2 mm. long, 1·5-1·7 mm. wide, scutellum about ⅔ as long as the caryopsis.

Country of Origin.

It is probably a native of India and has been here for at least twelve years, but details of its introduction and the date thereof are unknown.

Distribution and Habitat.

Up to the present, Urochloa Grass has been recorded from the black and reddish soils and, to a lesser extent, from the gravelly ridges of the Darling Downs District (Toowoomba, Drayton, Kingsthorpe, Jondaryan, Oakey, Pittsworth, and Warwick). It has also been collected on the heavy black soil flats around Beaudesert, in the Moreton District, as a minor weed of cultivation, and has been recorded from the Atherton Tableland. The grass seems to thrive on the more moisture-retentive clay soils in less exposed situations. A hot and dry summer causes severe wilting, though it soon responds to even light rains. On the Darling Downs, roadsides, old cultivations, and waste land often locally carry this as the dominant grass. So far as is known, Urochloa Grass has not been recorded elsewhere in Australia.

Potential Economic Importance.

Urochloa Grass comes away rapidly after the winter and early spring rains, and depending on the season, extent of grazing, and other factors, it may last until late in the autumn. It forms fairly dense stands, provides a fair quantity of leaf, and, in addition, is reputed to be palatable to stock. It is naturally more nutritious before seeding, which normally begins about February. On account of its rapid response after a dry spell it is often one of the first grasses to supply feed. Furthermore, one report from the Toowoomba district states that Urochloa was the only grass left by the grasshoppers in some places, during the recent plague, and that several dairy farmers were forced to rely upon it for a time for feed, with satisfactory results.

The main interest in Urochloa Grass at present, however, lies in the possibility of its use for the smothering out of Mint Weed, which is both a poisonous plant and a troublesome weed on the Darling Downs and in other parts of Queensland. Due to its rapid growth, its ability to form fairly dense stands, and its habit of seeding freely, several farmers have suggested that Urochloa Grass might be used to advantage for this purpose. In one instance, it is said to have replaced a heavy growth of Bathurst Burr* on vacant land over a period of a few years.

The optimum seeding takes place during the later summer and autumn months and the seed is easily hand stripped or swept from the ground and separated out. It is therefore suggested that in those areas where seed may easily be obtained and Mint Weed is a bad pest, Urochloa Grass might be well worthy of a trial.

Botanical Reference.

Urochloa panicoides Beauv. Agrost. 52, t.11, f.l. (1812).

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* *Xanthium spinosum* L.

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QUEENSLAND SHOW DATES FOR 1940.

The Queensland Chamber of Agricultural Societies has issued the following list of show dates for 1940:—

JUNE.

Wowan	6th and 7th
Maryborough	6th to 8th
Blackbutt	7th and 8th
Childers	10th and 11th
Boonah	12th and 13th
Bundaberg	13th to 15th
Gin Gin	17th and 18th
Gladstone	19th and 20th
Kilcoy	21st and 22nd
Rockhampton	25th to 29th
Toogoolawah	28th and 29th

JULY.

Mackay	1st to 4th
Esk Show and Campdraft	5th and 6th
Proserpine	5th and 6th
Bowen	10th and 11th
Nambour	11th and 13th
Ayr	12th and 13th
Rosewood	12th and 13th
Cleveland	12th and 13th
Townsville	16th to 18th
Maleny	18th and 19th
Charters Towers	29th to 31st
Gatton	23rd to 25th
Innisfail	25th, 26th, and 27th
Caboolture	26th and 27th
Atherton Show	30th and 31st
Crow's Nest	31st and 1st August
Maleny Show	abandoned for 1940

AUGUST.

Home Hill	2nd and 3rd
Pine Rivers	2nd and 3rd
Royal National, Brisbane	12th to 17th

SEPTEMBER.

Imbil	6th and 7th
Canungra	7th
Pomona	13th and 14th
Rocklea	14th
Malanda Show	18th and 19th
Beenleigh	20th and 21st
Ithaca	28th

OCTOBER.

Warwick Rodeo	5th and 7th

The Insect Parasites of Sheep.

F. H. S. ROBERTS, D.Sc., Animal Health Station, Yeerongpilly.

3 16

INSECTS play an extremely important part in the economics of the livestock industry, as they can be responsible for very serious losses. All classes of domestic animals are subject to attack by these pests, but, it is safe to say, no section of the livestock industry suffers more severely than the sheep industry. It has been estimated, for example, that blowflies alone cost Australia approximately £4,000,000 per annum, to which large sum must be added the losses from infestation by lice, keds, the nasal botfly, and other pests. This loss is measured not so much by mortalities but by the more important, but less obvious effects, such as loss of wool and condition, and the expenditure involved in carrying out control measures. No sheep-owner can therefore afford to ignore the various insect pests which attack his sheep. Their control and eradication is possible only when he is conversant with the manner in which they live and breed, with the damage they are capable of causing, and with the measures to be undertaken for their control.

The number of different kinds of insects which attack sheep in Queensland is by no means small. Fortunately, many of these are comparatively unimportant. Only the more serious pests will be considered here, such as blackflies, blowflies, lice, the ked, and the nasal botfly.

BLACKFLIES (*Simuliidæ*).

Popularly spoken of as ''sandflies,'' these flies are known to be serious pests of sheep and other animals in various parts of the State. They are small, robust, blood-sucking flies which appear in great numbers for a short period, following the flooding of the rivers and creeks by the summer rains.

The flies cluster thickly in the ears and nostrils and cause severe irritation and annoyance. These ill-effects are augmented by certain poisons which the flies inject into the body whilst feeding. Lambs suffer most severely and loss of condition and even death may follow an attack by these pests.

Blackflies breed only in running water, in which the eggs are laid and the larvæ and pupæ live. It is difficult, then, to recommend any practicable measure of control which deals with the breeding places of the flies. Protection of sheep from attack is at the present time possible only through the employment of smudge fires.

DESCRIPTION OF PLATE 138.

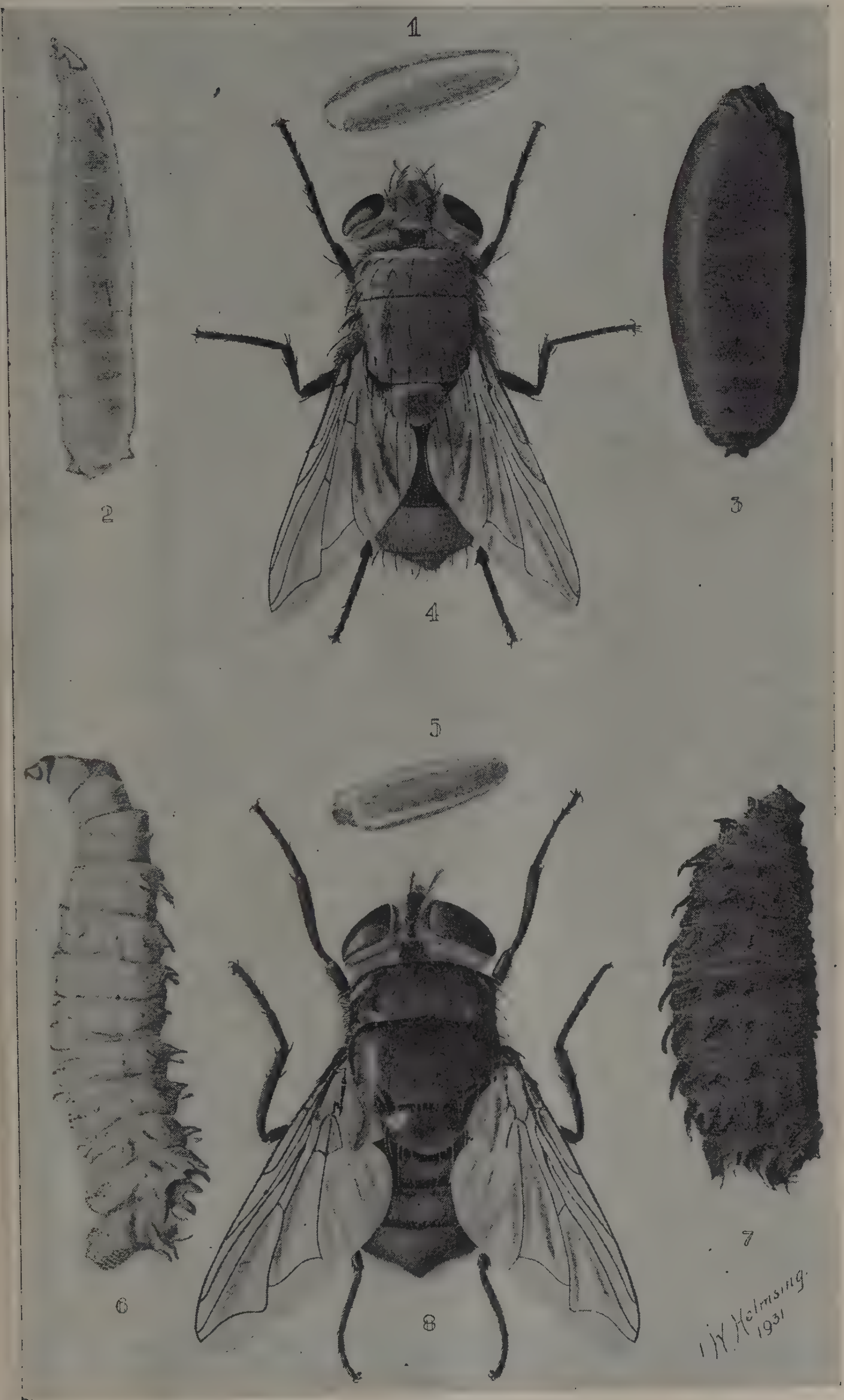
SHEEP BLOWFLIES.

Lucilia cuprina.

Fig. 1	Egg × 23.
Fig. 2	Maggot × 7.
Fig. 3	Puparium × 7.
Fig. 4	Adult Fly × 7.

Chrysomyia rufifacies.

Fig. 5	Egg × 23.
Fig. 6	Maggot × 7.
Fig. 7	Puparium × 7.
Fig. 8	Adult Fly × 7.


1
2
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I. W. Helmsing 1931

Plate 138.

SHEEP BLOWFLIES.

SHEEP BLOWFLIES.

Blowflies are generally regarded as species of flies which "blow" or lay their eggs on carrion, so in the ordinary course of nature acting as scavenges and helping in this way to get rid of offensive materials in a rapid and efficient manner. Some kinds of blowflies, however, have developed the habit of "blowing' live flesh also. In fact, in South Africa and America there are blowflies, the so-called screw-worm flies, in which this habit has been developed to such an extent that these flies now lay their eggs and can complete their growth only on live flesh. These screw-worm flies attack all kinds of animals. In Australia, however, blowflies are concerned principally with sheep, and are of little importance among other domestic animals.

The Species of Blowflies which Attack Sheep.

No less than seventeen different kinds of flies have been found to attack sheep in Australia. Some of these, however, are not true blowflies and are of little consequence. The more serious blowflies include—

Lucilia cuprina (Plate 138, fig. 4).—This fly is responsible for about 80 per cent. of cases of strike. It is widespread in its distribution, being most abundant during the spring and autumn. It is a slender fly, less than half an inch in length. The colour is usually a bright metallic green, sometimes with a bronzy tint. An examination under a lens shows a fair number of bristles on the body. A closely allied fly, *Lucilia sericata,* is of primary importance among sheep in Great Britain. This species also occurs in Australia, but is not at all serious here, being responsible for about only 0·5 per cent. of cases of strike.

Calliphora nociva and *Calliphora auger.*—These two species are very similar in appearance to one another. They both have a yellow or brownish body. The abdomen is blue, deeply blotched on either side of the basal segments with yellow. These blowflies frequently enter houses. They are most prevalent during the late winter and spring, and are next in importance to *Lucilia cuprina* as sheep blowflies.

Calliphora stygia and *Calliphora fallax.*—These are large and robust golden-coloured flies. Like the other species of Calliphora, they frequently enter houses and attract attention by their persistent buzzing and boisterous flight. They are most abundant in this State during the late winter and spring.

Chrysomyia rufifacies (Plate 138, fig. 8).—This blowfly may be readily confused with *Lucilia cuprina.* It is a much stouter fly, however, and the body is more bluish than greenish, though sometimes it is tinged green and even bronzy. If this fly is examined under a lens, very few bristles will be seen (cf. Lucilia). It will also be noticed that the colour is deeper on the edges of the segments of the abdomen, giving the abdomen a banded appearance.

Chrysomyia micropogon.—This fly is about the same size as *Calliphora auger.* It has large, reddish-brown eyes, a yellow face, and the body is uniformly dark metallic blue in colour.

Microcalliphora varipes.—This is the smallest of the blowflies attacking sheep, being only about half the size of the common house fly. It is bright metallic green in colour, with a pale yellow face.

These flies are all native blowflies with the exception of the species of Lucilia, which have been introduced from other countries.

Life History Notes.

There appears to be no distinct strain of blowflies that attack sheep, for such flies as strike sheep will readily lay eggs on carrion and *vice versa.* The life histories of the various species are all very similar, differing only in detail. It is therefore proposed to deal thoroughly with the life history of *Lucilia cuprina,* mentioning that of the others only by way of comparison.

The Egg (Plate 138, figs. 1 and 5).

The female fly may lay up to 3,000 eggs in her life time. These are deposited on carrion or in the wool in batches of 150 to 200. In wool, the eggs are usually laid low down and near the skin. The brown blowflies (*Calliphora* spp.) frequently deposit tiny larvæ instead of eggs. The newly-laid egg is white in colour and somewhat sausage-shaped. In summer time hatching takes place in twelve to twenty-four hours. In cooler weather hatching may be considerably delayed.

The Larva or Maggot (Plate 138, figs. 2 and 6).

As soon as they hatch, the young maggots usually make their way to the skin surface and commence feeding. For this purpose they secrete digestive juices which liquify the food material, though they are also capable of tearing off minute solid pieces of flesh which they devour whole. The process of feeding is assisted by bacteria which predigest insoluble material. The food material of the maggots consists of skin exudations, moist scales, &c. Sometimes they penetrate the skin, but this depends to some extent upon the duration and intensity of the infestation. In the warm summer weather the maggot is fully fed in three to six days. The maggots of *Lucilia spp.* and *Calliphora spp.* are smooth and creamy in appearance (Plate 138, fig. 2). Those of *Chrysomyia rufifacies* and *Microcalliphora varipes* are brown and covered with tubercles, the so-called ''hairy maggots'' (Plate 138, fig. 6). The maggots of *Chrysomyia micropogon* are also smooth and creamy, but are ''shivery.''

The Pupa (Plate 138, figs. 3 and 7).

When fully fed the maggots for the most part drop from the sheep on to the ground. They wander around for a while, but eventually penetrate the soil. Here they shrink and become barrel-like in shape. The outer skin hardens and turns brown. Inside this brown shell a wonderful transformation takes place, and eventually the complete insect is formed. When it is ready to emerge, the fly, by means of a pulsating bladder-like organ on the front of its head, pushes off the end of the brown case in which it is imprisoned and makes its way to the surface of the ground. Flies have been known to penetrate through four feet of soil in this manner. The fly is now very soft and drab in colour, but after a short time in the sun the body and wings dry, the colours appear, and the insect flies off.

The period spent in the brown barrel-shaped case or puparium is about eight days in summer or forty days or more in winter. Sometimes this pupation takes place in the fleece.

The Adult.

The female fly, after emerging, immediately seeks carrion so that she may have a meal of protein. Otherwise, her ovaries would fail to develop. After mating, the female then lays eggs. Egg laying may take place at the earliest five to seven days after mating. This gives a life cycle period from egg to egg of seventeen days during the summer.

Little is known of the biology of the adult flies, but some information concerning their range of flight and longevity is available. Blowflies may live up to ninety-four days and may fly at least ten miles. This means that flies breeding in carrion or on a sheep may be distributed over a tract of country at least twenty miles in diameter—an area of 314 square miles.

Strike.

Infestation of the living animal by fly maggots is known as myiasis or strike. Under Australian conditions, strike in sheep may be divided into five different types:—

(*a*) *Crutch or Breech Strike.*—This type of strike involves infestation of the crutch and constitutes the most common form of strike. It is seen chiefly in ewes, but is not confined to this class of sheep;

(*b*) *Body Strike.*—Body strike includes infestation of those parts of the body exclusive of the crutch, head, and pizzle. It is the most severe type of strike and usually involves the withers, back, loins, thighs, and sides of the neck and chest;

(*c*) *Pizzle Strike.*—This is seen only in rams and wethers and refers to infestation of the area adjacent to the pizzle;

(*d*) *Head Strike.*—This form of strike is seen chiefly in rams and includes the area at the bases of the horns.

(*e*) *Other Types of Strike.*—Here are included all other types of strike. Infestation of shear cuts, castration wounds, docking wounds, and other kinds of wounds, accidental or man-made in origin, are chiefly concerned here.

In the early stages of strike, the sheep may show little evidence of the presence of maggots beyond an uneasiness as shown by frequent twitching of the tail and stamping of the legs. The maggots may complete their development without penetrating the skin, which may merely become inflamed and weeping. If the skin is penetrated, a conspicuous raw, hot, and swollen wound develops and the animal suffers distinct discomfort. Provided the wound is not struck again, it usually heals and the animal recovers. Sometimes the wound becomes septic, in which case the animal may die. If, however, the wound is being continually struck it enlarges rapidly, hairy maggots appear in it, and these tend to burrow into the flesh, forming pockets. Animals in this stage may die unless treated. Badly struck sheep wander away from the mob and lie down under bushes and in other secluded places where they are difficult to find.

The losses caused by blowflies are enormous. Mortalities are frequent, but far greater damage is brought about by the loss of wool and condition. The wool lifts from the wounds and is also shorn away from the surrounding areas when dressings are applied. The disturbance to the animal's constitution may also result in a marked break in the fleece. There is finally the tremendous expenditure involved in handling and treatment.

Infestation of living flesh by blowfly maggots may under certain circumstances, on the other hand, be beneficial. During the Great War it was noticed that wounds which had been attacked by maggots showed a decided tendency towards rapid healing. Subsequently, it was demonstrated that the application of maggots reared under sterile conditions to certain types of wounds in man which were long delayed in healing, such as osteomyelitis, brought about a rapid recovery. This "maggot therapy," as it is called, has since been used extensively all over the world. Further work showed that the healing properties of the maggots were due to a particular substance secreted by them. This substance is called allantoin. Either this compound or its derivative urea is now proving very efficient in the treatment of osteomyelitis, bad burns, and other such wounds which are long delayed in healing.

Factors Influencing Strike.

The conditions influencing the prevalence of strike are by no means completely understood. It has been ascertained, however, that these conditions include certain factors which (*a*) govern not only the presence of "primary" flies, but also their activity and abundance, and (*b*) render the sheep not only attractive to the flies but are also favourable to the development of the maggots.

Primary Flies and Conditions Influencing Their Activity and Abundance.

Although there are several species of blowflies which attack sheep, some of these may be present without strike being evident. Observations have shown that the sheep blowflies may be divided into two groups, according to the manner in which they react to the various stages of decay in carrion. Should an animal die, certain species are attracted to the carcase and will lay their eggs on it only while the carcase remains comparatively fresh. Once it reaches a certain stage of decay it is not longer suitable to them for egg laying. After the maggots of these flies have been at work for some time, the carcase is then selected for egg laying by other species of flies. Thus, blowflies become divided into primary and secondary flies, the primary flies including those species which visit the carcase first and lay their eggs on it whilst the flesh remains comparatively fresh. Furthermore, infestation of carrion by primary flies' maggots assists the carrion to reach that stage of decay when it becomes attractive to the secondary flies. If primary flies are absent the carcase may simply dry up and the maggots of the secondary flies may not appear in it at all. *Lucilia spp.* and *Calliphora spp.* are primary flies, whilst *Chrysomyia rufifacies* and *Microcalliphora varipes* are secondary flies.

In the case of blowing of sheep, these two groups of flies play a similar part to that enacted with carrion. Strike is initiated usually by the species of *Lucilia* and *Calliphora,* and previous infestation with the maggots of these flies is usually necessary before the hairy maggots of *Chrysomyia rufifacies* and *Microcalliphora rufifacies* appear. The position with regard to *Chrysomyia micropogon* is not known with any degree of certainty. It is believed that this fly is secondary to a certain extent, but that in the presence of wounds and abrasions which have reached a certain stage of decay its maggots are able to exist without the previous presence of maggots of the primary flies. In most cases, however, strike can be initiated only by the primary flies, and in their absence very little blowing of sheep would be evident.

There is yet a group of tertiary flies which appear in carrion when it is approaching the dried-up, mummy-like stage. None of these is a true blowfly and the group comprises certain species of flesh flies, the house fly and other allied species, and a medium-sized black fly called *Peronia rostrata.* These have also been bred from the living sheep, but are of little importance.

Primary flies are most abundant and most active during warm and mild wet humid weather. Such conditions are usually seen during the late summer, autumn, and spring. Intense activity may also be observed during mild wet winters. During the heat and dryness of summer, on the other hand, primary flies practically disappear and there is little or no strike.

The influence of humidity or moisture on blowfly activity is well known to those sheep owners whose properties contain low-lying damp pastures or pastures with heavily-timbered streams or waterholes, for here strike is always more severe than in cleared, dry pastures.

Factors which Render the Sheep Attractive.

Before a sheep becomes attractive to the flies and strike can develop the area attacked must not only be moist but must remain moist long enough for the eggs to hatch and for the maggots to reach the skin. Moisture, it is believed, plays its part by increasing the activity of bacteria in the fleece and by irritating the skin, causing inflammation with its accompanying exudate. Thus, it is considered that sheep with delicate skins which are thereby very susceptible to the presence of moisture are also very liable to strike.

Fleece Rot.—An excellent example of the association of moisture, bacterial activity in the fleece and on the skin, and susceptibility to strike is to be found in a condition of the fleece known as fleece rot. This condition occurs during continuous mild, wet, and humid weather. It is very attractive to the flies and is the principle cause of body strike. As a result of bacterial activity, the wool fibres are matted together and crusts are formed which lift from the skin as the wool grows. Usually, the affected wool is grey to light-brown in colour, but frequently, owing to the presence of colour-producing bacteria, green, purple, pink, red-brown, and yellow colourations are seen, occurring as bands in the fleece. The areas affected with fleece rot are usually small, up to 3 inches in diameter, and commonly occur on the withers, back, rump, and sides of the neck or chest.

Crutch Strike.—Crutch strike in ewes is due chiefly to the soiling of the crutch wool by urine, thus keeping this area moist. Diarrhœa may act in a similar manner.

Pizzle Strike.—Pizzle strike in rams and wethers is associated with the same conditions as the principal cause of crutch strike in ewes—that is, the wool adjacent to the pizzle is kept moist by urine.

Other Causes of Strike.

From the above it would appear that any factor which predisposes to the fleece becoming and remaining wet, or to any part of the body retaining moisture, is of the greatest importance in susceptibility. Several such factors have been implicated and these include—

(i.) Certain Characteristics Associated with Body Conformation.

(*a*) *Body Folds or Wrinkles.*—The presence of folds or wrinkles in the breech is one of the causes predisposing to strike in this area. By reason of these folds, this part of the body is unable to dry out and so remains continuously wet, both from body exudations and in ewes also from urine. In fact, it has been demonstrated that sheep may be divided into classes in which susceptibility to crutch strike is definitely linked up with the degree of wrinkling in the breech, plain bodied animals being least susceptible.

In rams, particularly in those with close set horns, strike at the base of the horns, especially in wet, humid weather, may be associated with the presence of a skin fold in this area which maintains the moist conditions requisite for the development of strike;

(*b*) *Conformation of the Hind Quarters.*—Bad conformation of the hind quarters, in which the hocks approach one another, is also conducive to crutch strike, as this characteristic prevents the urine being delivered clear of the body;

(*c*) *Malformed Vulvæ.*—Frequently, in ewes, the tip of the vulva is directed sideways, which is conducive to the soiling of the crutch with urine. Such malformation is, in many instances, a sequence to injury, particularly from careless shearing;

(*d*) *Conformation of the Withers.*—The conformation of the withers is highly important in susceptibility to body strike in this region of the body. If the conformation is such as to favour a retention of moisture, this area becomes very susceptible. The most susceptible type of wither is one showing ''pinch'' or ''grip.'' In the former case there is a definite hollow behind the wither. If this hollow or pocket becomes so exaggerated as to form a ''grip'' the wither is extremely susceptible. Sheep with high shoulder blades or very broad withers are also likely to be struck in this area;

(ii.) Fleece Characteristics.

These operate, chiefly, according to the degree the fleece can become and remain wet. They are of the greatest importance in susceptibility to fleece rot and body strike;

A fleece which is regarded as being comparatively insusceptible shows good character, soft handling, and is bright. A susceptible fleece, on the other hand, lacks character, and is harsh and yellow in colour;

Density of the fleece is also important and sheep which lack density in their fleece, particularly on the withers, may be regarded as susceptible subjects.

Control.

The control of blowflies attacking sheep is, unfortunately, not in a very happy position, despite the immense amount of work that has been done. The measures investigated have followed two main lines—namely, (*a*) measures which aim at reducing the numbers of the flies, and (*b*) measures which take into consideration protection of the sheep.

Measures which Aim at Reducing the Numbers of Flies.

Trapping.—To meet with any measure of success, the flies that are trapped should consist principally of primary flies. Furthermore, the majority of the primary flies captured should be egg-bearing females. Carrion is the only bait known to attract blowflies in any numbers, but, unfortunately, carrion attracts primary flies only over the very short period that it remains comparatively fresh. The vast majority of the flies that are attracted and caught in traps with a carrion bait are secondary flies. It has been shown that greater numbers of primary flies may be attracted if sodium sulphide is added to the bait. Furthermore, it has also been demonstrated that an intensive system of trapping in which such a prepared bait is employed may be responsible for a decided reduction in the number of cases of strike. To achieve this purpose, however, such large numbers of traps are required that this method of control becomes economically unsound.

Carcase Destruction.—To the logical mind, the destruction of carrion in which blowflies breed would appear to be decidedly beneficial. It has already been pointed out that strike depends chiefly on the presence of primary flies, but rather strangely the number of primary flies that breed through in carrion is very small. In fact, it has been shown that many more primary flies can be bred from a struck sheep than from a sheep carcase. Anyone observing the seething mass of maggots in carrion must at once be struck by the tremendous competition for food which is going on among them. The primary fly maggots which have hatched from eggs laid during the first three to four days of death have to compete for food not only among themselves but with larger numbers of secondary fly maggots whose numbers are increasing every day. These secondary fly maggots, particularly the hairy maggots, are much more robust and voracious. As a result, large numbers of primary fly maggots are driven from the carrion and die. Eventually, too, the carrion reaches a stage of decay when it is no longer suitable as food for the primary fly maggots and further numbers are killed.

To be in any way beneficial, the carcase must then be treated whilst it contains mostly primary fly maggots, that is, within three to four days of death. The most efficient method of destruction is by burning. Failing this the carcase should be dusted liberally all over with a powder consisting of one part of borax and two parts of fine dust, or should be saturated with an arsenical solution.

Burial of carcases is not recommended, as in some way or other it favours the breeding of the primary flies.

A further feature which renders carcase destruction impracticable is that every carcase, including all those of birds and small animals, must be searched for over a wide area and destroyed or treated.

Measures which Aim at Protecting the Sheep.

Undesirable Body and Fleece Characteristics.—These are best dealt with by rigid culling and careful breeding. Breeding towards a plain-bodied sheep with a bright, relatively insusceptible fleece does not affect either the quality or quantity of the clip.

Breech wrinkles may be removed by surgical means. At the same time distorted vulvæ may be straightened (Mules's operation). It has been demonstrated that if this operation is applied at lambmarking the incidence of strike in after life can be decreased to a significant degree. Care should be taken when docking to leave the ewe lambs' tails short enough so that they do not interfere with the free passage of the urine by pressing on the vulvæ.

In some quarters Mules's operation is not regarded very favourably, as it is considered to prevent to a large degree the more desirable breeding out of the undesirable characteristics.

Crutching.—By this term is meant the shearing of the wool from the region of the breech and over and above the tail and down the back of the legs. It is of undoubted value in preventing strike, as the removal of the wool permits these parts to remain dry for some time (at least six weeks). Crutching, however, is rather costly. It costs at least 1½d. per sheep, and there is, in addition, the loss from shortening the staple of crutchings. There is also the inconvenience of mustering and driving to the shearing shed for treatment.

Jetting.—This is cheaper than crutching and may be applied at a moment's notice on any part of the property where yards are available to hold the sheep. Jetting involves the application of an arsenical solution in a thin jet to the breech of the sheep at a pressure sufficient to penetrate the fleece and saturate the skin. Sheep may continue to be struck after jetting, but the maggots are poisoned as soon as they begin to feed. The pressures employed vary according to the age of the sheep and the density of the fleece, but should not xceed 150 lb. to the square inch. If carefully carried out, jetting may be depended upon to give a four to six weeks' freedom during even severe waves of strike.

The jetting formula which has given most success is one recommended by the Department of Agriculture in New South Wales. It consists of—

White arsenic	4 lb.
Caustic soda	½ lb.
Stone lime	4 lb.
Water	40 galls.

The best and cheapest protection is given by a judicious combination of jetting and crutching.

Dipping.—The use of dipping fluids containing the amount of arsenic used against lice and ked (0.2 per cent. arsenious oxide) may be regarded as being of little practical value in preventing strike.

Dressings.—The ideal dressing for struck sheep would be one that would (*a*) kill the maggots in the wound, (*b*) promote healing, and (*c*) prevent reinfestation of the wound.

Unfortunately, the ideal dressing has yet to be discovered. The following dressings are the result of recent work and are claimed to give good results. Dressings Nos. 1 and 2 are recommended by the Department of Agriculture of New South Wales, and dressing No. 3 by the Council for Scientific and Industrial Research:—

Dressing No. 1.

Sulphate of zinc	10 oz.
Powdered starch	4 oz.
Carbontetrachloride	8 oz.
Water	7 pints.

Directions.—Dissolve the zinc sulphate in the water. Add the starch and heat gently till the mixture becomes a watery jelly. Cool, add the carbontetrachloride, and mix thoroughly.

Dressing No. 2.

Powdered starch	4 oz.
Boracic acid	7 oz.
Carbontetrachloride	8 oz.
Water	7 pints.

Directions.—Prepare as with Dressing No. 1, adding the boracic acid to the water.

Of these two dressings, No. 1 is said to be more effective. Both should be retained in closed vessels.

Dressing No. 3.

	Parts.
Rectified oil of camphor	13·2
Potassium hydroxide	4·1
Boracic acid	10
Oleic acid (red oil)	2.9
Water	100

This dressing is rather difficult for the sheep owner to make up himself, and is best purchased. It is known as C.B.E. dressing. For any caring to attempt its manufacture, the following directions are given:—

Directions.—Dissolve 1 lb. of potassium hydroxide in 1½ gallons of water. Add 2½ lb. of boracic acid and stir or heat gently till dissolved. Make the solution up to 2 gallons and cool. Use finely powdered boracic and add it in small quantities.

Take a three-gallon vessel and mix 3·15 lb of oil of camphor with 0·6 lb. of oleic acid (red oil). Add to this the above solution in small quantities, stirring vigorously. Heat then to 60 degrees C. with constant stirring, continuing the stirring till cool.

LICE.

Lice are small, flat, wingless insects with strong legs well armed with spines and claws. Some kinds of lice have a broad, squarish head and feed on hair, scales, scurf, and other debris lying on the skin surface. These are known as biting lice. Other lice have a somewhat pointed head and are provided with tubular mouthparts by which they are able to pierce the skin and suck up blood and other fluids. These are the sucking lice.

Lice are permanent parasites, in that they occur on the host in all stages of their life history and are incapable of surviving for any length of time if they are removed from their host. Their life histories are all very similar, differing only in detail. The female louse lays eggs which she attaches to the hair or wool of the host. In time the eggs hatch and the young lice that emerge differ from their parent chiefly in size. The young lice feed and grow, passing through several stages of growth, each of which is preceded by a moult or casting of the skin, until they become adults.

Two kinds of lice infest sheep in Queensland—namely, the biting louse or red-headed louse, *Bovicola ovis,* and the sucking louse or foot louse, *Linognathus pedalis.*

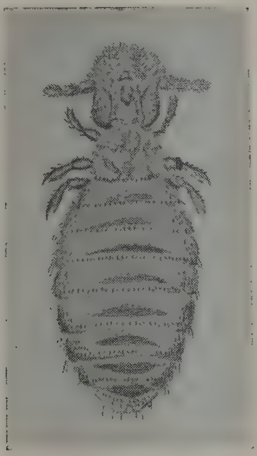

Plate 139.
RED-HEADED SHEEP LOUSE (*Bovicola ovis*) × 48.

L.

The Red-Headed Louse (*Bovicola ovis*) (Plate 139).

This species has been long established in Queensland. It measures about 1/25th of an inch in length and has a broad, reddish head from which it derives its common name. The abdomen is pale in colour, with a number of dark transverse bands.

This is the more common sheep louse and is well distributed throughout the State. It is found close to the skin among the wool of the neck, shoulders, back, and thighs. When the infestation is severe, it may occur on practically all parts of the body.

The eggs of the red-headed louse hatch in from six to 10 days. The young lice reach sexual maturity sixteen to eighteen days later.

Osb

The Foot Louse (*Linognathus pedalis*) (Plate 140).

The foot louse is a sucking louse. It is by no means as common as the red-headed louse, but has a wider distribution and is known to occur in several areas of the State, such as the far Central-West and South-West, where the red-headed louse is comparatively rare or absent. The foot louse has a short, bluntly-pointed head and measures up to 1/12th of an inch in length. As its common name implies, it is found chiefly on the hairy portions of the legs and adjacent parts of the body. Heavy infestations may spread to adjoining woolled parts.

The eggs of this species hatch in ten to eighteen days. The young lice begin to lay eggs when they are eleven to twelve days old.

Effect of Lice Infestation on the Sheep.

The irritation associated with lice infestation may be so severe as to interfere seriously with feeding and resting. As a result, animals may fail to put on condition and young sheep particularly may be stunted in growth. The most important effects of infestation, however, concern the wool. Infested animals constantly rub against fence posts and other objects and scratch and bite at themselves. As a result, the fleece becomes ragged and torn and thus greatly decreased in value. A further loss is to be found in wool which has become stained from the parasites' excreta.

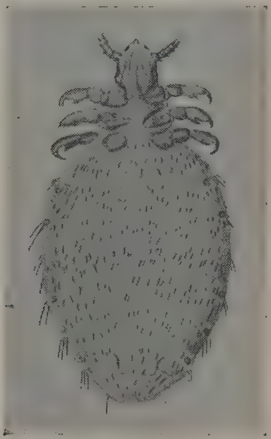

Plate 140.
FOOT LOUSE (*Linognathus pedalis*) × 48.

Treatment and Control.

Once present in a flock lice spread very rapidly. Undoubtedly, most of the infestation occurs through direct contact with lousy animals, but it should not be forgotten that clean sheep may become infested from yards and buildings which have previously housed lousy sheep.

Lice spend the whole of their life upon the sheep and are incapable of breeding or living for any great length of time away from it. Both eggs and adults, however, are often able to survive for brief periods in tags of wool which have become detached. An infestation may thus have its origin in the shearing shed or in yards. Strict sanitation in the shearing shed is therefore very desirable. After infested sheep have been shorn, all loose tags of wool should be carefully gathered and burnt or otherwise safely disposed of and the shed given a thorough disinfection. If a shed is not used for about a month, there is no risk of infestation.

Sheep infested with the red-headed louse may be cleansed by dipping in an arsenical or carbolic dip. These dipping fluids, however, do not kill the egg. It is therefore necessary to dip again after an interval of fourteen to sixteen days. This interval permits all the eggs that survive the first dipping to hatch, but is not long enough to allow the lice that hatch to reach maturity and lay further eggs.

The leg louse is much more difficult to control, for it is fairly resistant to the arsenical and carbolic dips employed against the red-headed louse. The best fluids to employ against the leg louse are—(*a*) A solution of nicotine sulphate containing one part of nicotine sulphate (40 per cent. nicotine) to 800 parts of water, or (*b*) certain proprietary fluids containing derris or rotenone. Complete immersion of the sheep is not required, the bath being just deep enough to cover the infested portions of the body as the animals walk through it. Best results follow two to three treatments at intervals of ten days.

When dipping sheep the following principles should be borne in mind:—

(1) The best time for dipping is six to eight weeks off shears. By this time the wool is long enough to hold the dip and all shearing cuts will have healed;

(2) Prepare the dip carefully and according to the directions given by the maker.

(3) Don't dip when the sheep are hot and thirsty, when the weather is very hot or very cold, or when it is raining. Yard the sheep sufficiently long before dipping so that they have time to cool off;

(4) Choose a warm sunny day for dipping and allow the animals ample time to dry before driving them.

(5) Don't overcrowd or rush the animals through the dip. Make sure the heads are wetted by ducking them under once or twice. Best results follow from at least one minute's swim;

(6) Dip the rams and any weak sheep separately. Rams require plenty of room and attention and are more susceptible to any ill-effects from dipping than other sheep;

(7) Don't dip the ewes and lambs together, and keep them apart till some time after dipping;

(8) Retain the animals in the draining pen until the dip ceases to run. This prevents wastage of dip and contamination of the pastures.

When dipping, the muster should be as complete as possible. Any sheep that are missed will quickly reinfest the flock. Attention is also directed to the danger of broken fences and of travelling stock as sources of infestation.

The Sheep Ked (*Melophagus ovinus*) (Plate 141).

This parasite is frequently spoken of as the sheep "tick." The term "tick" is erroneous, for the insect is not a tick at all, but a wingless fly. In colour, the ked is reddish or grey-brown and may measure up to nearly one-quarter of an inch in length. The insect has a very peculiar appearance, owing to the head being sunken into the thorax. The legs are strong and covered with spines. The ked is capable of moving very rapidly among the wool and its movements are distinctly crab-like.

This parasite is most numerous among the wool of the neck, breast, shoulders, belly, and thighs. It is most frequent on the southern areas of the Darling Downs.

Life History.

The egg is retained and hatches within the body of the female. The larva is not deposited until it is fully-grown, when it is attached by the female to the wool. At this time it is enclosed in a soft, white membrane, which in about twelve hours hardens and becomes brown in colour and barrel-like in shape. This is called the pupa and measures about one-eighth of an inch in length. The young ked gradually forms inside the pupa and is ready to emerge nineteen to twenty-four days later. The female commences to deposit larvæ ten to twenty-three days after emergence. The total number of larvæ a single female is capable of laying is not known with any certainty, but is considered to be ten to fifteen. These are deposited for a while at least at the rate of one every seven to nine days.

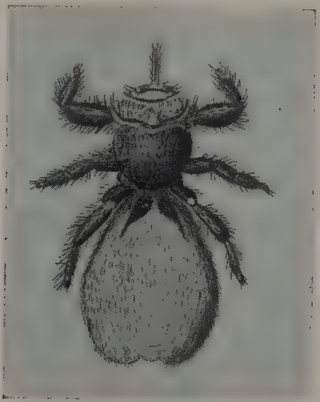

Plate 141.
SHEEP KED (*Melophagus ovinus*) × 14.

Effect of Ked Infestation.

The ked lives on blood, which it secures by piercing the skin with its mouth-parts. Heavy infestations may readily cause loss of condition. Infested wool becomes ragged, broken, stained, and greatly reduced in value.

Control.

Like the lice, the ked spends the whole of its life upon the sheep, and is incapable of breeding elsewhere, as is frequently thought. The adult insect, however, has been known to live as long as eighteen days when detached from the sheep, though usually the survival period is not as long as this. The pupæ have been known to remain viable for as long as forty-two days in tags of wool which have become removed from the sheep by biting and scratching. Here again, as in the case of lice, sheep may become infested in two ways—either by direct contact with infested sheep, which no doubt is the chief method of spread, or from yards, sheds, and paddocks which have housed infested sheep. In order, therefore, to make sure that such yards, sheds, and paddocks are clean, it would be necessary to spell them during the warmer months for a period of about two months. During the winter, however, if the temperature drops to freezing at any period during the day or night, adult ticks will not survive longer than about five days, and as pupæ are readily killed by frosts, such infested yards, &c., need not be spelled longer than a week. Shearing-shed sanitation is again stressed.

The keds on the sheep may be killed by dipping in an arsenical solution as used for biting lice. Arsenic, however, has little effect on the pupæ and for this reason a second dipping after an interval of twenty-one to twenty-five days is necessary for eradication.

Attention is directed to the principles of dipping as laid down for lice.

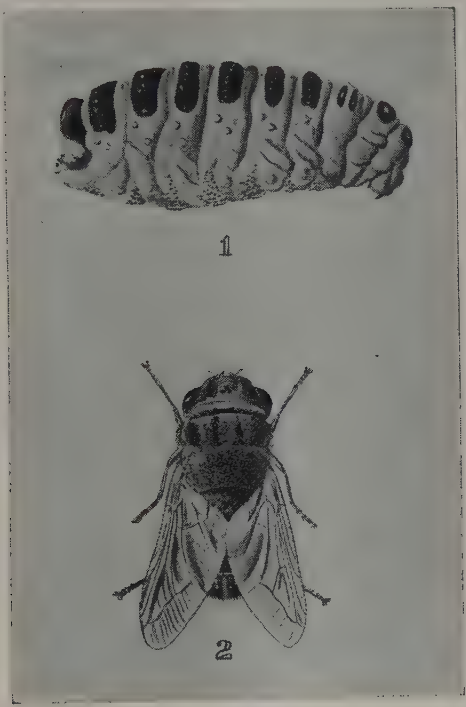

Plate 142.

SHEEP NASAL FLY (*Oestrus ovis*).

Fig. 1.—Larva × 6. Fig. 2.—Adult Fly × 6.

The Sheep Nasal Fly (*Oestrus ovis*) (Plate 142, figs. 1 and 2).

This is a squat, dark-grey, bristleless fly, extensively marked with silver-grey (Plate 142, fig. 2). It has a wide distribution throughout the State and is to be seen during the spring and summer months. The fly is most active during the warmer hours of the day, and in the early morning and towards evening may be seen resting on various objects in the sun. The adult fly has only rudimentary mouth-parts and cannot feed. It lives about four weeks.

Life History.

The female fly deposits a tiny larva or maggot on or near the nostrils. The maggot quickly makes its way up into the nostrils and into the communicating cavities. It then attaches itself to the membrane lining these cavities by a pair of stout mouth hooks. Here it feeds on the pus and exudate its presence occasions. In young lambs the larva may be fully grown in about twenty-eight days, but in older sheep full growth is not attained until after about sixty-five days or more. The mature larva measures a little more than an inch in length. The dorsal surface is marked with black bands and the ventral surface bears rows of small spines (Plate 142, fig. 1).

When mature, the larva leaves the sheep's nostrils, usually being sneezed out, and having fallen to the ground burrows into the soil for protection. The larva now shrinks and its outer skin hardens and turns black. This pupal or resting stage may occupy four weeks to three months, depending on the season of the year. At the end of this period the adult fly emerges, dries its wings, and flies off.

Effect on the Sheep.

The presence of nasal bot flies keeps sheep in a somewhat frantic condition, and in their endeavours to prevent the fly from attacking they will hold the nose in the dust or against other sheep, frequently moving wildly around the paddock. This reaction interferes with feeding and resting, and if the flies are active over a long period is sufficient to prevent the animals from thriving.

The larvæ in the cavities of the nostrils irritate the lining membranes, which become inflamed and swollen. An intense purulent discharge passes down the nostrils, sometimes in such quantities as to interfere with the animal's breathing ("snotty nose"). Infested animals are irritated, do not feed well, and so lose condition. Heavy infestations may be fatal.

Control.

These flies are not considered to fly very great distances and for this reason are most numerous around permanent camps and watering places.

Smearing the nostrils with pine tar, which has been so often recommended in the past to prevent the fly from attacking sheep, is now regarded as being of little value. Experimental work in other parts of the world has shown that the grubs in the nostrils may be killed by applying to *each* nostril—

(*a*) Two cubic centimetres of equal parts of carbon-bisulphide and liquid paraffin, or

(*b*) Two cubic centimetres of equal parts of tetrachlorethylene and liquid paraffin.

To apply these mixtures the sheep is placed flat on its back with the head on the ground and held at an angle of 45 degrees. The correct amounts are inserted into each nostril by means of a syringe fitted with a short piece (two inches) of rubber tubing. The animal is retained in this position for ten to fifteen seconds after the mixture has been injected.

Acknowledgment.

Plates 139, 140, 141, and 142 are the work of the late Mr. I. W. Helmsing, Illustrator, Department of Agriculture and Stock.

Two Plants Poisonous to Stock.*

E. H. GURNEY, A.A.C.I., Agricultural Chemist, and W. D. FRANCIS, Botanist.

[*Contribution No.* 6.]

THE two plants, *Heterodendron oleæfolium* and *Ximenia americana*, are included with plants which have been proved to be poisonous to stock, and samples of these plants at different periods during a year's growth were collected by officers of the Department and forwarded to the Poison Plants Committee[1] for investigation. Samples of *Heterodendron oleæfolium* were forwarded from Blackall and Dalby districts and samples of *Ximenia americana* from Clermont.

Results of the determination of the hydrocyanic acid content of samples of *Heterodendron oleæfolium* collected in New South Wales have been published by Ramsay and Max Henry in the "Agricultural Gazette" of New South Wales, November, 1929, and by Finnemore and Cooper in the "Australian Veterinary Journal," August, 1938. Further reference to some of the data in these publications will be made later.

The analyses herein recorded were undertaken as the sources from which these plants were collected have essentially a summer rainfall, and it was therefore thought desirable to confirm previous work as to *Heterodendron oleæfolium* and find out if *Ximenia americana* behaved similarly.

METHOD OF ANALYSIS.

The method of analysis used by us was that of Finnemore (Aust. Journal of Pharmacy, 30th January, 1935, p. 41) with the slight modification that the distillate was collected in a saturated solution of sodium bicarbonate.

The analyses were made on the moist material as received, a moisture determination being made (at 105 deg. C.) at the same time as the determination of HCN and then the HCN calculated in terms of moisture-free plant, this latter figure being shown on the accompanying graphs.

Emulsin was used in every determination.

Heterodendron oleaefolium.

Heterodendron oleæfolium is a tree with a wide distribution in Australia, being found in all the Australian States. In Queensland it is most abundant as a member of the mixed timber and Brigalow and Belah scrubs of the mid-west. It forms a very shapely tree when growing in the open. Good specimens have a heavy head of foliage and provide excellent shade. The leaves are narrow, 3-4 inches long, and frequently of rather a pale, almost ashy green. The flowers are insignificant but sometimes borne in great abundance. The seed vessel or fruit consists of one to three pea-like lobes, each containing a single seed. Boonaree is perhaps the name by which is is most widely known and is the most suitable vernacular. Rosewood, Emu Bush, Cattle Bush, Whitewood, and Dogwood are names frequently given to it. They belong, however, more correctly to other trees.

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* *Heterodendron oleæfolium* and *Ximenia americana.*

[1] A committee established by the Department of Agriculture and Stock as the result of a grant from the Australian Wool Board for the purpose of conducting investigations upon plants suspected of being toxic to sheep.

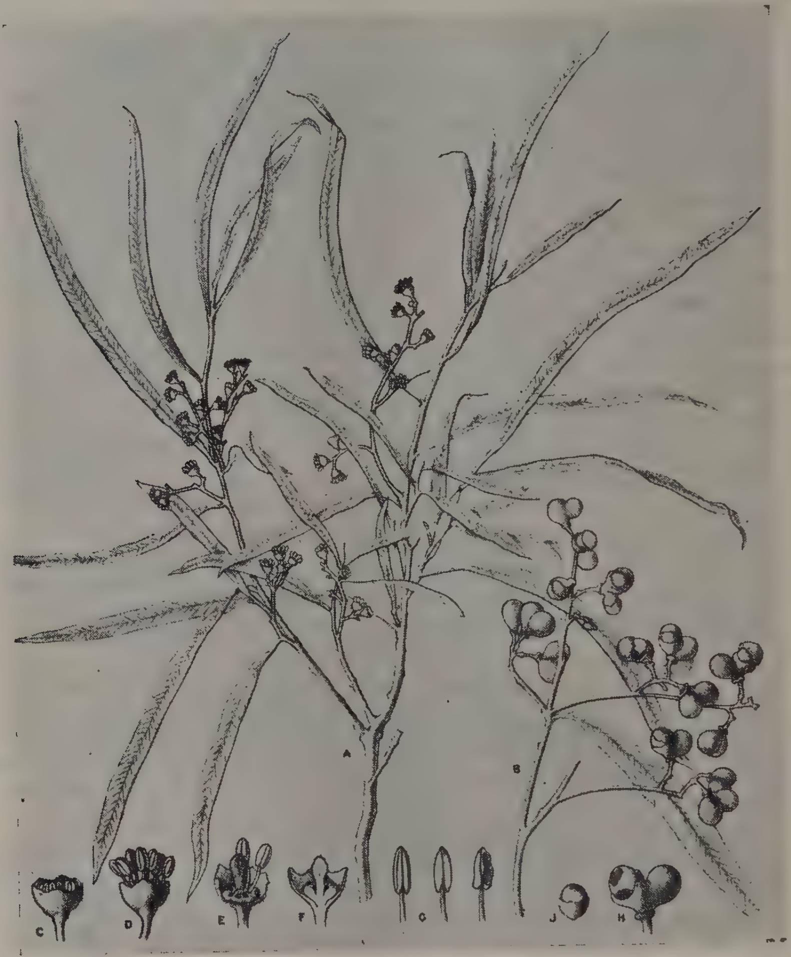

Plate 143.

BOONAREE OR WESTERN ROSEWOOD (*Heterodendron oleæfolium*).

[*Reproduced from the "Forest Flora of New South Wales," by J. H. Maiden.*]

Up to October, 1937 (line AB on Plate 144), no differentiation was made between broad and narrow leafed forms of *Heterodendron oleæfolium* from Blackall, so samples to that date were all treated as normal (broad-leafed) form. Again, after July, 1938, only one sample of the broad-leafed form was received each month, and this was treated as "mature leaves" on the graph (line CD).

The supplies of *Heterodendron oleæfolium* (narrow-leaf form) from Blackall consisted of a mixture of mature and young growth, and Plate 144 therefore represents the average HCN content of the leaves of the plant during the period represented.

In Graph No. 1 it will be seen that the HCN content of the young leaves of this plant increases to 151 mg. in December, then after a slight decrease it again increases to 152 mg. in February, after which date a regular decrease occurs until June in the plant samples

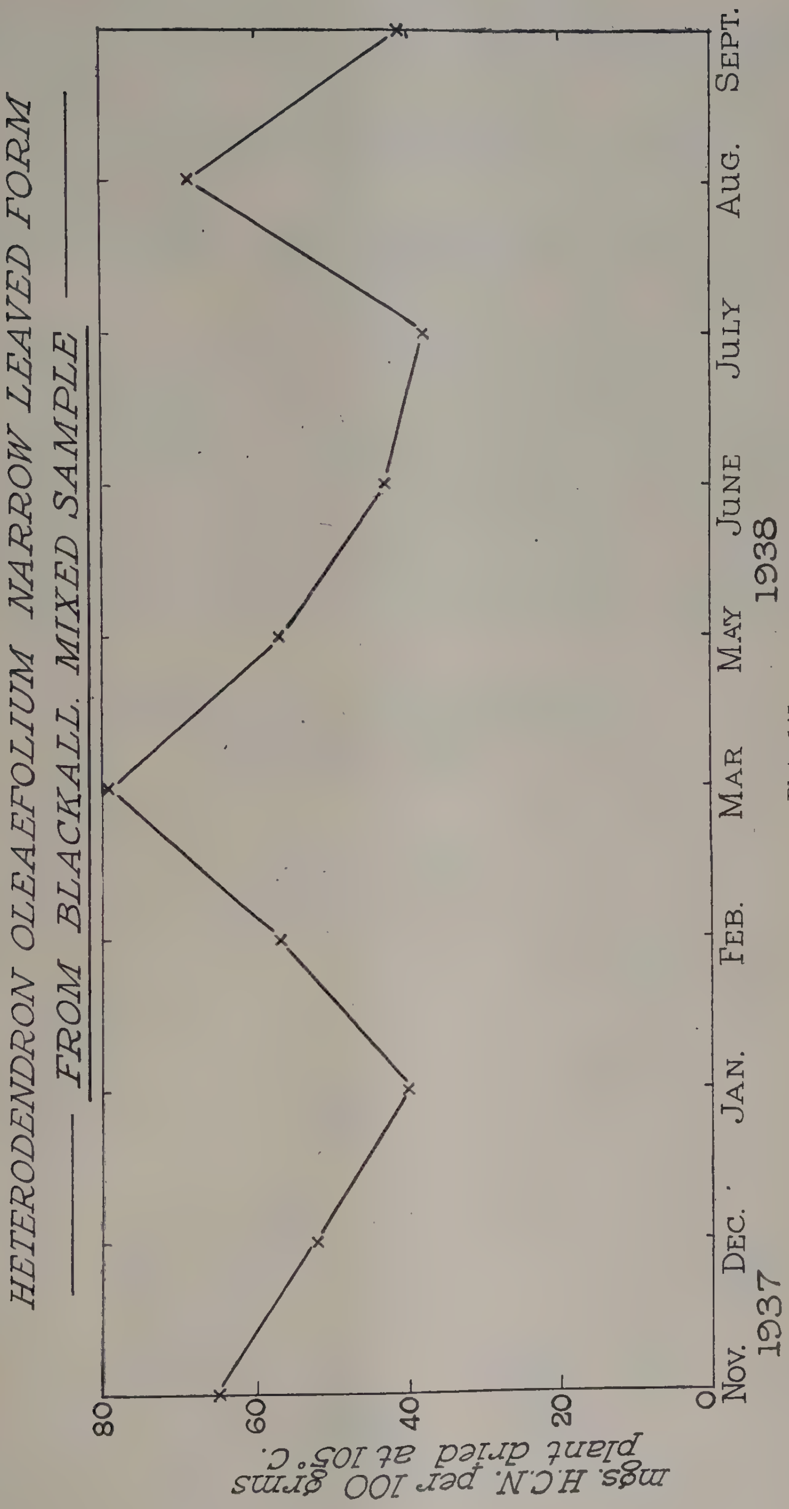
HETERODENDRON OLEAEFOLIUM NARROW LEAVED FORM
FROM BLACKALL. MIXED SAMPLE
80
60
40
20
0
mgs. H.C.N. per 100 grms plant dried at 105° C.
NOV.
DEC.
JAN.
FEB.
MAR
MAY
JUNE
JULY
AUG.
SEPT.
1937
1938

Plate 145.

submitted. Though the mature leaves have a lower HCN content than the young leaves, an increased content occurs similarly in the summer months.

In the case of the narrow leaf variety (Plate 145) no differentiation was made between young and mature growth, and in this case the HCN content is not consistently high in the summer months.

From the figures obtained on samples of the broad-leaf plant submitted from Blackall during the year 1938, the content of hydrocyanic acid is greater in the summer months December and February, and in the narrow-leaf form is at its maximum in March.

Ramsay and Henry[1] published in 1929 results of examination of this plant growing in New South Wales, and reported that the yield of hydrocyanic acid reaches its maximum in the late summer and early autumn (March, April, May), falls to a minimum during the late winter and early spring, and begins to increase about November. In 1938 Finnemore and Cooper[2] published analyses of this plant collected in 1936 from various districts of New South Wales, and in samples collected during 1936 the highest content of hydrocyanic acid, 125 mg. per 100 gm. dried sample, was found in a sample collected in November, whereas with samples collected in 1937 and 1938 the highest content, 300 and 321 mg. per 100 gm. dried plant, was found in samples collected in the months of March and April.

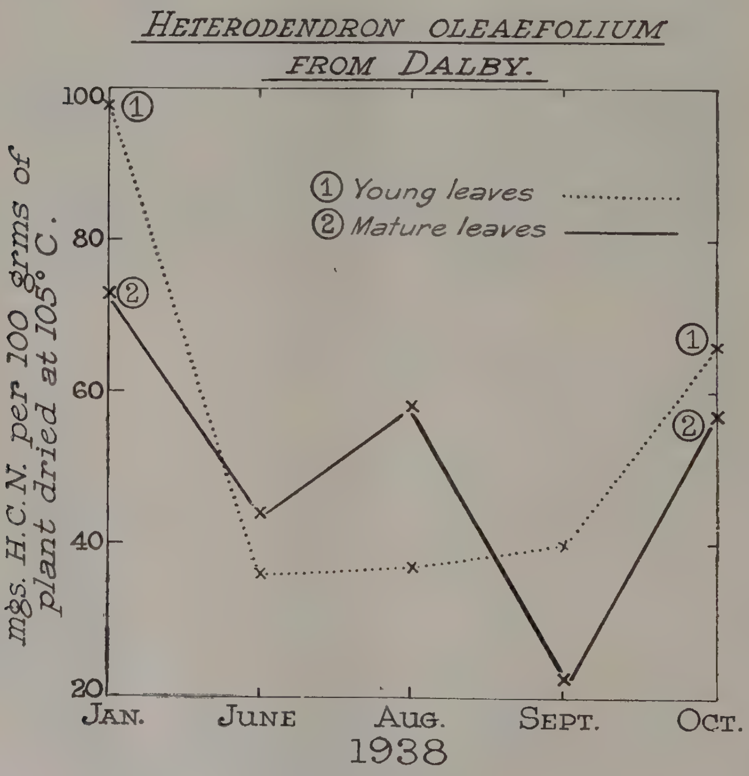

Plate 146.

Only a few samples of *Heterodendron oleæfolium* were received from the Dalby district, the analyses of which are detailed in Plate 146, this showing lower figures for material collected during the winter than in spring or summer (this latter being the highest).

Reviewing the information obtained, therefore, it is seen that our results substantiate those obtained by other workers and that the greatest danger of poisoning from *Heterodendron oleæfolium* is to be expected in late summer and early autumn.

The hydrocyanic acid (HCN) contained in plant glucosides requires a suitable enzyme for its liberation, and in the publication of Finnemore and Cooper, mentioned before, it is distinctly shown by numerous comparative analyses of *Heterodendron oleæfolium* without and with added enzyme that the enzyme existing in this plant does not liberate all the HCN present and, as other plants eaten by stock commonly contain suitable enzymes, it is generally accepted that they are responsible for the liberation of HCN from the glucosides in this plant. All results reported in this article are considered as being the maximum content, as in all cases an enzyme has been added before analyses were made.

Ximenia americana.

Ximenia americana is a shrub with a wide distribution along the shores of tropical countries, including Australia and New Guinea. In Queensland it is not only found on the coast, but extends some considerable distance inland, and is most frequent as clumps or thickets in mixed timber or in Lancewood scrubs. It is an intricately branched shrub, frequently spiny. The leaves are usually a pale shining green. They are oblong or elliptic in shape and about 2 inches long. As the local name indicates, the fruits are like a small yellow plum, an inch to an inch and a-half in diameter, and contain a single seed.

The analyses of samples of *Ximenia americana* received from the Clermont district are represented on Plate 147.

After July, 1938, only one sample of *Ximenia americana* arrived each month, and these samples have been used in continuation of the "young leaves" graph (line AB), though they could equally have been included in the mature leaf graph. The portion of the graph to the right of the line AB therefore represents the average HCN content of the mixed, young, and mature leaves from August to November, 1938.

Frequent qualitative tests have demonstrated the presence of HCN in this plant and it was listed by Smith and White[3] in 1918 as a cyanogenetic plant, and Finnemore, Cooper, and Harris[4] record that with the addition of an enzyme 0·31 per cent. HCN (310 mg. per 100 gm. dried plant) was obtained, and that without addition of enzyme 0·28 per cent. HCN (280 mg. per 100 gm. dried plant) was obtained. This shows that sufficient enzyme exists in this plant to liberate practically the whole of the HCN present.

It will be seen from our analyses that the hydrocyanic acid (HCN) content fluctuated erratically throughout the period the plant was under investigation, but the reason for such variation in HCN content cannot be stated. Young leaves, however, at each testing gave a higher figure than mature leaves, and hence would be more dangerous to stock.

Conclusons.

1. Our analyses confirm the fact that *Heterodendron oleæfolium* contains a hydrocyanic acid (prussic acid) yielding glucoside.

2. This varies in different stages of growth, but frequently contains sufficient hydrocyanic acid to be dangerous as feed for stock.

3. The plant yields the greatest amount of HCN in late summer and early autumn.

4. *Ximenia americana* contains sufficient hydrocyanic acid at all stages of growth to be dangerous to stock.

Acknowledgments.

The grant from the Australian Wool Board to the Department of Agriculture and Stock has made possible the examination of the above plants. The assistance of the Wool Board is appreciated by the Department.

It is desired to acknowledge the assistance of Mr. W. G. McKechnie and Mr. W. R. Winks for the analytical work detailed in this article, and to Messrs. S. L. Everist, W. A. Kearney, and E. T. Lewin, who were responsible for the collection and forwarding of samples.

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[1] Ramsay and Henry, Agr. Gazette of New South Wales, Nov. 1929, p. 834.
[2] Finnemore and Cooper, The Aust. Veterinary Journal, Aug. 1938, p. 153.
[3] Smith and White, Proc. Roy. Soc., Queensland, 1918, p. 86.
[4] Finnemore, Cooper, and Harris, Jour. Chem. Ind., 1938, p. 162.

Plate 148.

A SOUTH BURNETT WILD FOWL SANCTUARY.—Lake Booinbah, near Boonara, on the Goomeri-Gayndah road.

Problems of Keeping Milk in the Home.

O. KUDELKA, Bacteriologist, Brisbane Milk Board.

A HIGH-QUALITY milk for drinking purposes has to satisfy several conditions. It has to be fresh, free from pathogenic germs, it has to contain as few as possible milk bacteria which are not pathogenic, and has to possess all nutritional properties in good proportions. In short, a high-quality milk has to be clean, safe, and rich. To produce, handle, transport, and to sell such a product certain methods must be applied, otherwise some defects in the milk will become apparent.

Among the conditions for the production of a high-quality milk the temperature plays a very important part.

The amount of bacteria present in freshly drawn milk coming from a healthy cow is always very low. The increase in the bacteria in the milk is caused by two factors. Firstly, external contamination that occurs during the handling with unsterilised utensils, or by dust contamination; and, secondly, the multiplication of the original milk bacteria at a favourable temperature. The multiplication of all bacteria depends on media, temperature, and time. The medium of milk is one of the best, and is very suitable for the multiplication of the milk bacteria and the bacteria commonly coming from external sources. The most favourable temperature for this development is over 70 deg. F., the optimal temperature being between 70 and 90 deg. F.

Thus can be understood the importance of the cooling of the milk immediately after milking to keep its original low bacteria count, and also the need for strictest cleanliness in handling.

The function of time is simply explained since, above a certain temperature, the number of bacteria increases proportionately to the length of time the milk is stored. This multiplication, however, is limited since the development of bacteria is checked by the by-products of the bacteria themselves if they are present in too high numbers.

Even after its supply to the household, milk must be treated very carefully. It has to be kept in the cleanest utensils (best in the bottle it is delivered in), and placed in a very cool spot. Milk should not be kept more than a certain time before being used. It is better to have a small quantity delivered twice a day than a large quantity once a day.

To study the bacterial changes in milk which take place when it is kept at different temperatures for different periods of time experiments were carried out.

Six bottles of a milk with a low bacteria count (pasteurised milk) coming from the same batch arrived early in the morning in the laboratory and were examined in the following way:—Bottle No. 1 was tested immediately. Bottles Nos. 2, 3, 4, and 5 were put on a table and kept at atmospheric temperature for different periods before being examined. Bottle No. 6 was kept in the refrigerator for the duration of the experiment. After every two hours one of the bottles on the table was examined bacteriologically by the plate count test. Bottles 5 and 6, both kept for eight hours, but at different temperatures, were tested at the same time. The following are the results:—

No.	Time Examined.	Atmospheric Temperature. Degrees.	Bacteria Count.
1	8.30 a.m.	67·9	12,000
2	10.30 a.m.	70·2	164,000
3	12.30 p.m.	71·0	920,000
4	2.30 p.m.	70·7	1,200,000
5	4.30 p.m.	69·0	2,960,000
		Refrigerator Temperature. Degrees.	
6	5 p.m.	56·0	2,900

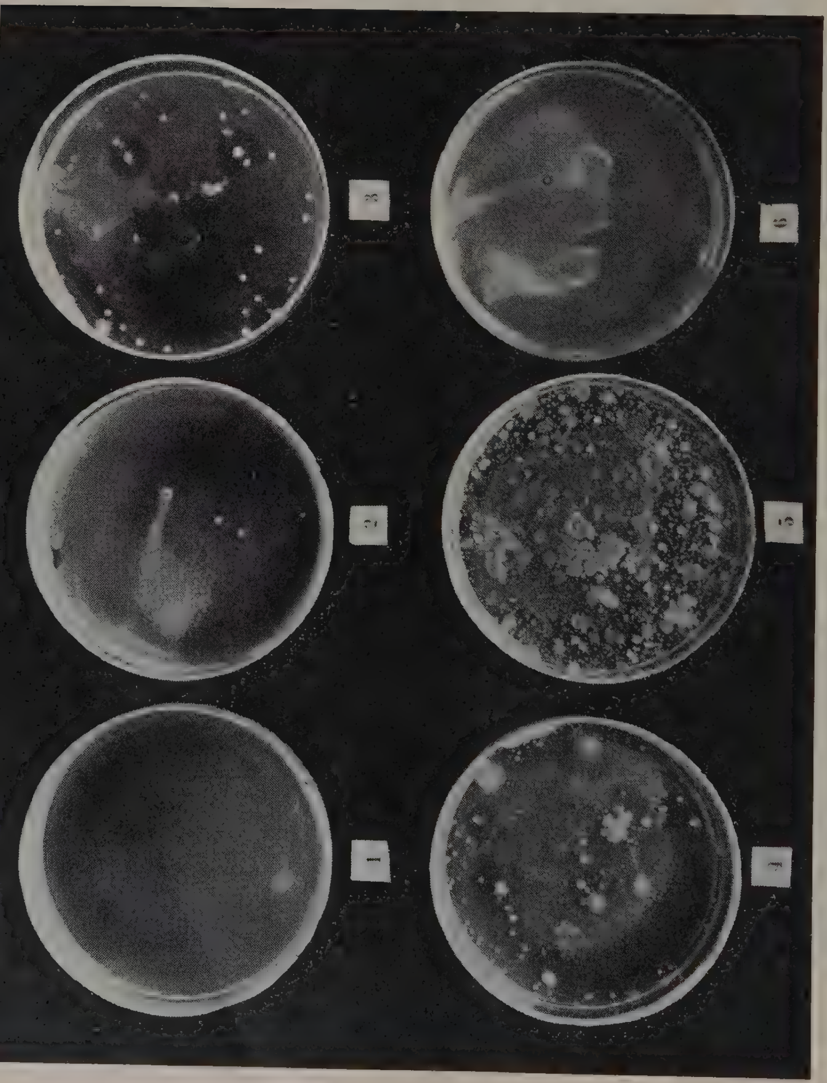

Plate 149.

The cloudy effect in Fig. 6 is not caused by colonies but by sterile milk which was added to the medium. The colonies are always distinctly visible.

The picture of the six plates (Plate 149) demonstrates very significantly the steady increase in the number of bacteria which takes place if milk is kept at a high atmospheric temperature for long periods. It can easily be seen that the last milk plate, which showed the count of the milk which was kept in the refrigerator, demonstrated that there was no increase in the number of bacteria during the eight hours before the examination.

It could, however, be argued that pasteurised milk, as a treated milk, has lost some of its supposed forces of resistance and can therefore not be used as an example. Like all other arguments against pasteurisation, even this is not founded on fact. Very many experiments have proved that milk, if it is properly pasteurised, does not lose one of the good qualities of the raw milk, but is freed from all pathogenic germs that could be present in it.

Nevertheless, in order to deal with this argument a second experiment was carried out with raw milk and the same methods of examination were applied. A very clean raw milk was used and kept at atmospheric temperatures. After every two hours a plate test was carried out. A sample of the same milk was kept for eight hours in the refrigerator and examined at the end of this period together with the last sample of milk kept at atmospheric temperature. The following are the figures:—

No.	Time Examined.	Atmospheric Temperature. Degrees.	Bacteria Count.
1	8.30 a.m.	67·9	12,000
2	10.30 a.m.	70·2	164,000
3	12.30 p.m.	71·0	920,000
4	2.30 p.m.	70·7	1,200,000
5	4.30 p.m.	69·0	2,960,000
		Refrigerator Temperature. Degrees.	
6	4.30 p.m.	56·0	14,000

Both experiments seem to prove the importance of cold storage of milk, even at home, and stress that the time of storage should be limited unless at a temperature below 60 deg. F. The higher the temperature, the shorter the time of storage should be.

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Irrigation Practice on Brie Brie Estate, Mossman.

BY W. H. CRAWFORD AND G. BATES.*

ALTHOUGH this far northern portion of our cane area has an annual rainfall of almost ninety inches, most of this falls in the first three months of the year, and invariably crops suffer from lack of soil moisture in the spring; this is reflected in the tonnage harvested during the following season. The following figures, taken from the "Queensland Agricultural Journal," give the average monthly precipitation at Mossman over a period of twenty-five years:—

	Inches.
January	17·84
February	18·57
March	17·49
April	7·82
May	3·37
June	2·46
July	1·34
August	1·28
September	1·71
October	2·91
November	4·49
December	10·18
Total	89·46

An examination of these figures shows that even in an average year there is a lack of soil moisture in the early life of the crop, particularly when it is remembered that, although records may show fair showers in successive months, it is quite possible that these may have fallen early in one month and late in the next, giving often a period of six weeks dry weather; this causes a check in growth at a critical stage in the life of the crop. When the rainfall is below average the position becomes, of course, much worse. For example, although the average for August, September, and October amounts to approximately six inches, in the year 1937 only 2·25 inches fell over this period. This is probably the chief factor responsible for the 1938 crushing in Mossman being referred to as "the drought year."

In 1938, it was decided by Brie Brie Estate to investigate the possibilities of irrigation. Although in this year 40 acres were watered, the project was not commenced until November, and was more in the nature of a preliminary trial, which paved the way for a fuller understanding of the routine to be adopted in the future. Fortunately, there was no difficulty in obtaining a supply of water. This was drawn from the open river, the water of which is of high degree of purity, and the supply almost unlimited. The nature of the soil to be irrigated, and the undulating character of the land made flood irrigation impracticable, except in a few isolated paddocks, so that it was necessary to adopt the spray system.

The pumping plant (see Plates 150 and 151) consists of a wheel-tractor, developing 40 H.P. at the pulley, and a 6-inch centrifugal pump, directly mounted on an extension of the tractor chassis. The pump is connected to the intake by a 6-inch flexible pipe. The tractor runs on kerosene, burning 2 gallons per hour, and the pump delivers 30,000 gallons per hour.

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* In *The Cane Growers' Quarterly Bulletin* for April, 1940.

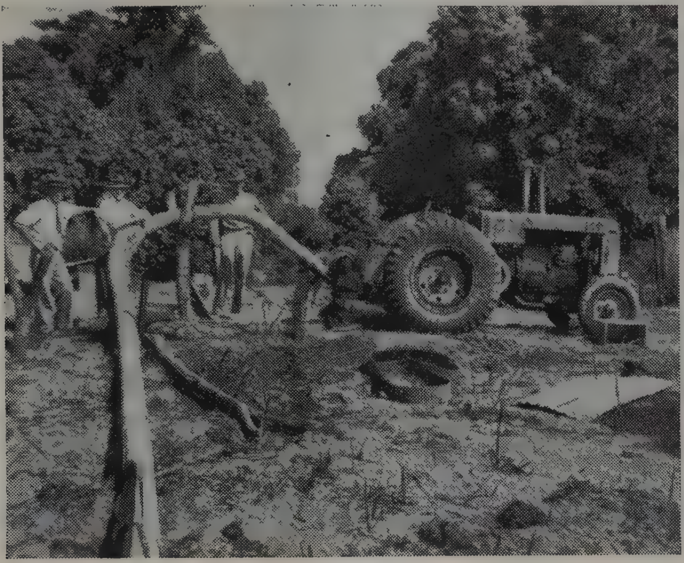

Plate 150.
ILLUSTRATING THE ARRANGEMENT OF TRACTOR, PUMP, AND FLUMING, BRIE BRIE ESTATE.

The mounting of the pump on the tractor chassis has proved a great convenience. As water is drawn from the river, different sites may be selected for different blocks, so that time and trouble is thereby saved when changing over, for it is not necessary to line up the pump at every shift. It is found that the average lift from the river to the pump is 12 feet, and blocks watered are usually 30-35 feet above water level.

The fluming and spray equipment consists of 25 chains of 6-inch 22-gauge galvanised piping, with quick acting couplings, and 27 chains of 4-inch spray line. These are in 17½ feet lengths, and a spray nozzle covering a square of 35 feet side is fitted at the centre of each alternate pipe. The spray uprights are of 1 inch diameter in lengths from 1 to 4 feet. In practice it is found possible to spray cane which is 18 inches higher than the upright used. Thus cane which is 2 feet 6 inches high is sprayed from 1 foot stand pipes.

The spray nozzles are hemispherical, having 81 holes, in nine rows, set at different angles, and are fitted with gauze screens. They may be removed easily for cleaning; this is done twice per day with the exception of the end nozzle which is cleaned at every change. The equipment also includes a number of 6-inch flexible bends, T-pieces, and four gate valves. The landed cost of the equipment was £800, exclusive of the tractor. The maximum length of spray line used is 13 chains; thus 13 chains x 35 feet, or roughly 0·7 acre, may be watered at each setting. The land is sprayed for one hour, applying the equivalent of 1·75 inches of rain. The soil type is mainly clay loam, and it is found in practice that unworked land can be sprayed for one hour without flooding. Worked land will absorb 2·25 inches which is obtained by spraying for about one and a-quarter hours. While one line is being sprayed, the other is being changed, a job which takes thirty minutes—two men being employed. These men also look after the tractor and clean the sprays.

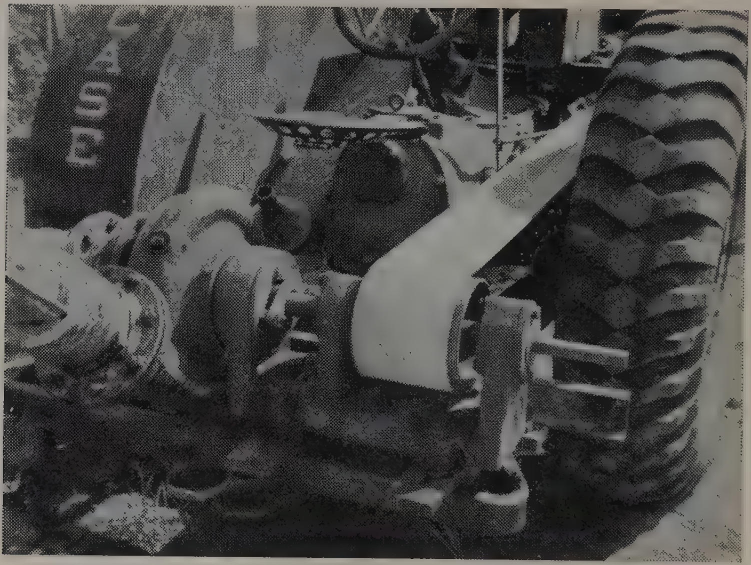

Plate 151.
SHOWING THE MANNER IN WHICH THE PUMP IS ATTACHED TO THE TRACTOR FRAME.

With the four gate valves, three changes may be made without stopping the engine. Care must be taken, however, that all air is driven out of the new line, before the old line is closed. If this is neglected then burst fluming will result. Precautions must be taken at the pump intake to prevent debris entering the spray system. The suction pipe is protected by fine gauze, with an outer covering of $\frac{1}{2}$-inch mesh netting. It is found that algae often give trouble in the dry weather; however, major blockages are caused by trash and dirt, which are picked up with the wet pipes, when changing over, and a little care taken to prevent dirt getting in the joints will save trouble later on.

Mains must also be packed at the joints when on uneven ground, and where gullies exist, furrows have to be made across the fall to prevent scouring. In handling ratoons, the practice is to rake and burn the tops, and then the disc harrows are run over the land; the crop has generally been burnt before harvesting. The block is then watered for one hour. Later it is grubbed twice, fertilized, and ultimately watered again for one and a-quarter hours.

During 1939, conditions for cane growing were considered to be above the average, although, as usual, there was a dry spell in the early spring. Only 36 points of rain fell in July, 68 in August, and 91 in September. Irrigation was commenced in September, following the August rain. Forty-seven acres were watered twice, and 12 acres once. Following this, 552 points of rain fell in October, 1,016 in November, and 437 in December, so that further watering was not considered necessary.

It was found that 5 acres may be irrigated per day, and allowing for shifting and lost time, the cost works out at roughly £1 per acre per watering.

Cold Resistant Sugar Cane.

AN experiment, which is being watched with great interest by the rest of the world, is now being carried out in the United States under the general direction of Dr. E. W. Brandes, Principal Pathologist-in-Charge of the Division of Sugar Plant Investigations in the United States Department of Agriculture.

Dr. Brandes will be remembered by many Queensland growers as the leader of an expedition which explored New Guinea by aeroplane in 1928 and made a considerable collection of different types of sugar cane which looked promising for use as commercial or breeding canes. This collection was made available to the Bureau, but none of the commercial type canes proved to be suitable to our conditions; certain selected breeding canes, however, are now in use in our cross-pollination programme. Dr. Brandes again visited Queensland in 1935 during the Conference of the International Society of Sugar Cane Technologists and left here on a visit to the South Sea Islands for the purpose of collecting further types of sugar cane. He or his deputies made similar journeys to other countries at various times and some three years ago he received from Central Asia a variety of sugar cane which may play an important part in the sugar world.

The variety in question was received from Turkestan, and during the past three years several further importations of the same type of cane have been made. It is quite probable that there are many such varieties of wild cane in the vast stretch of country between the Caspian Sea and Western China, but the difficulties of travel in such remote parts have prevented visits by plant explorers.

The outstanding characteristic of this type of cane—popularly known as the ''Turkestan'' cane—is its ability to withstand extreme cold. The first importation was grown in the vicinity of Washington, the national capital of the United States, at a latitude similar to that of Tasmania. During the winter time, in spite of the fact that 15 to 20 degrees of frost were registered, the plants remained green and few of the lateral buds were killed. The cane was also found to grow quite rapidly under the comparatively cold conditions of spring, as experienced in Washington.

Now the sugar-cane industry of Louisiana suffers under the extreme disability that late autumn frosts kill the cane, so that it has to be harvested before it is ripe, while early spring frosts prevent its early planting or ratooning. As a result, sugar cane in Louisiana has a growing season of only some seven or eight months per year. It was, therefore, natural that Dr. Brandes and his associates should be very interested in the cold-resistant qualities of the Turkestan cane, and visualise the possibility of crossbreeding it with some of the Louisiana canes in order to produce a commercial cane which would have a longer growing season.

Accordingly, it was decided to attempt to cross this Turkestan cane with ordinary commercial cane, but a difficulty was immediately encountered in the fact that the wild Turkestan specimen arrowed in mid-summer, whereas the commercial varieties of sugar cane arrow in late autumn. However, this difficulty was overcome by taking advantage of the reversal of seasons north and south of the equator. Enquiries showed that commercial varieties of cane would be arrowing in the

Republic of Colombia, in South America, at a time when the Turkestan cane was arrowing in the northern hemisphere.

Cuttings of the Turkestan cane were planted in boxes, and when the arrows were just about to emerge they were crated and shipped down to Colombia as fast as possible. When removed from the crates the arrows were in good condition and they were then set in position in contact with arrows of commercial varieties of sugar cane. At the same time pollen was collected in special containers from the cane which was arrowing in Washington, and these containers were then rushed by aeroplane to Colombia and there the pollen was dusted on to the flowers of commercial canes.

This experiment was carried out in August, 1938; both methods proved successful and some 15,000 hybrid seeds were obtained and taken back to Washington by air. The seed was planted immediately on arrival and gave rise to large numbers of seedlings which are obviously hybrids between the two types of cane. They have shown improved vigour over the wild type and have also demonstrated their ability to withstand cold which would have killed ordinary varieties of cane.

A large number of these hybrids arrowed last year and in August, 1939, pollen from these (as well as a second lot from the wild cane) was sent to Colombia by aeroplane for dusting on to commercial cane types. Success again followed the venture and there are now growing in Washington large numbers of seedlings which are the grandchildren of the Turkestan cane—that is to say, they contain one-quarter wild Turkestan "blood." At the time of latest reports these seedlings were quite small, and it could not be determined whether they contained any commercial types; a further back-cross on to ordinary sugar cane may still be necessary.

It should, of course, be quite possible to produce, in this way, commercial varieties which will retain some of the cold resistance of the Turkestan parent, and if and when this is successfully concluded a considerable benefit should be conferred on some of the sub-tropical cane-producing countries. On the other hand, of course, it should not be concluded that the world's cane sugar industry will thereupon migrate to countries like Tasmania and New Zealand: the sugar-cane family contains many members, the stalks of which contain little or no sugar. This is particularly true of the so-called "wild" canes which, in addition, have such thin stalks that they would produce a very small crop per acre. Consequently, in order to get varieties which will yield satisfactory tonnages of sugar, it is necessary to cross the wild cane back on to the noble cane several times. Each back-cross to the noble cane improves the thickness of stalk and sugar content but, at the same time, it must naturally "dilute" the characteristics inherited from the wild forbear. We must therefore expect that as the progeny from the Turkestan cane are back-crossed to noble canes, they will lose a good deal of their resistance to extreme cold.

Nevertheless, it will be a very great achievement if there can be produced an otherwise suitable cane which will be able to withstand temperatures of, say, 28 deg. F. instead of being killed at 32 deg., and perhaps this is as much as we could expect. Of course, it is possible that there will result a commercial cane which could be grown in Tasmania—but it is decidedly not probable.

A.F.B.

—In *The Cane Growers' Quarterly Bulletin* for April, 1940.

Plate 152.

AERIAL VIEW OF MERINGA SUGAR EXPERIMENT STATION.

Hay Crops for Cane Farms.

BY N. J. KING.*

DISCUSSIONS on alternative crops for the canegrower have laid little stress on the importance of hay crops in the farm economy. The following notes have been written primarily for south Queensland conditions—as it is in such climatic limits that experience in hay crops has been obtained at the Bundaberg Experiment Station. Practices in the production of fodder crops for farm stock vary considerably in the southern districts, but it may be said to follow, roughly, the following lines:—

(1) In the crushing season cane tops form the basis of the feed—supplemented with molasses, grain, or lucerne chaff—depending on the individual farmer.

(2) In the slack season (or growing season) some cane tops from volunteer ratoons left for the purpose, sorghums, maize, saccaline, fodder canes, and some maize grain are used.

The above crops are usually fed as chop-chop in the green state with or without the admixture of grain and/or molasses.

In the harvesting season the collection of tops from green cane does not involve much time or expense, and no doubt the tops constitute a good roughage basis when supplemented with other foods. In the slack season, however, the collection of any of the above green crops is perhaps more costly in time and labour than is generally recognised. In the summer months green feed has to be cut, carted, and put through the chaff-cutter daily so as to ensure some degree of freshness in the product; and time can be ill-afforded for this work during a period when cane cultivation and planting are of paramount importance.

The advantage of a hay crop is that it may be stored in the barn after curing, a good supply of chaff can be prepared on a wet day when farm operations are impossible, and the minimum of time and labour is required in feeding the stock. A further argument in favor of the hay crops is provided by the present disease position in the Bundaberg district. The growing of maize must be looked upon as a particularly risky proceeding in view of the seriousness of the downy mildew position. The obvious decision in such a case is for the minor crop to give way to the major one, and it is a particularly short-sighted policy to grow such a disease-susceptible crop as maize on cane farms where the major crop is thereby endangered. Any fodder crop which is going to endanger the growth of cane should therefore be eliminated in or near the diseased areas.

Sufficient has been written in previous bulletins regarding lucerne growing in South Queensland to justify its omission from these notes; the value of lucerne hay is admitted by all, and no further recommendation is needed here. The only point worthy of further consideration is in relation to flood irrigation of lucerne. On the Experiment Station this crop has been watered by sprays since 1935, but on many farms where irrigation water is available, and the expense of a spray system does not seem justified, it is a relatively simple matter to introduce the flooding system by means of a little judicious grading. There are several flooding systems for such crops, and the layouts are available to any interested growers. The level forest lands around Bundaberg lend themselves admirably to this method of watering.

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* In *The Cane Growers' Quarterly Bulletin* for April, 1940.

Sudan grass (*Sorghum sudanense*) is one of the most valuable hay crops for the south Queensland climate. It is a rapid-growing annual, suitable for green fodder, silage, or hay, but on account of the several accidents following the grazing of the young green crop it is recommended that the hay crop only be used. For hay purposes about 15 lb. of seed per acre should be sown broadcast. If a cane crop has just been ploughed out it is advisable after harrowing the seed in to roll the ground with a heavy roller. This flattens down any stools lying on the surface so that they will not interfere unduly with the mower when harvesting the crop. Sudan grass is a summer-growing crop, and at least two cuts—sometimes three—may be obtained from a single seeding. The first crops are cut when commencing to flower, and the final cut is obtained when the crop is in full bloom. It should not be allowed to seed, since the presence of much seed imparts a bitter flavour to the resultant hay.

Care should be taken that only pure seed is used. Sudan grass and sorghum cross-pollinate very readily, and Sudan-sorghum hybrids would be obtained in the next seeding. In curing the crop good hay can be made by leaving on the ground for twenty-four hours after mowing, then raking into windrows for further curing. Five or six days are needed generally for complete curing of the hay, before stacking in the barn. The feeding value of the hay is good, and horses maintain very fine condition on Sudan grass hay.

On the Bundaberg Experiment Station three crops have been grown in four months, the average height being approximately 4 ft. 6 in. to 5 ft. Crops such as these require a fair amount of plant food, and should Sudan grass be sown following the ploughing out of a cane crop a dressing of sulphate of ammonia—about 1 cwt. per acre—should be given the crop during the early stages of growth. Sudan grass in good condition has a dark green colour, and any yellowing of the crop is indicative of nitrogen starvation. It may be advisable on the red volcanic soils to apply also some potash.

Another crop grown to a very slight extent around Bundaberg, and yet capable of making a good hay crop, is oats. Oaten hay is an admirable food for stock and in the average winter in this district a good crop can be obtained. Three varieties have been grown here—Algerian, Sunrise, and Belar. Of these Algerian was the best yielder and made the best quality hay; Sunrise was next, and Belar the poorest. In such proximity to the coast it is inevitable that some rust will appear on the crop, but unless this assumes serious proportions the hay will not be adversely affected. Sunrise was found to be the most resistant to rust of the above varieties.

Field peas or vetches can be sown with oats to make a good-quality mixed hay, but unless the winter rains are above average the crop of peas or vetches will be poor. Normally they climb on the oats stems and are mown and cured together.

Neither of the two crops is expensive to plant. They are easily grown and both make excellent hay crops. It would appear to the writer that it is actually cheaper to grow and cure such crops for hay than to expend continually valuable time daily in cutting and carting cane tops during the growing season, and converting them into chop-chop.

The Dairy Farm

Milk Straining.

ON the most carefully managed farm, a certain amount of visible dirt finds its way into the milk. The term "visible dirt" covers such matter as dust, cow hairs, flies, and manure, as distinguished from bacteria, which are not visible to the naked eye. Bacteria may be present in milk which appears perfectly clean, fresh, and pure—and their presence may not be realised until souring begins several hours after contamination. If visible dirt is present in the milk, however, bacteria will be there also, hence the necessity for straining through a suitable strainer. The cotton wool disc type prescribed by the Dairy Regulations is preferable to any other. It can only be used once, and there is no risk of contaminating fresh supplies of milk, as sometimes happens with a cloth strainer which has not been properly washed.

It is better to keep visible dirt out of the milk than to strain it out. Early straining is better than last-minute straining, for to some extent the longer dirt is allowed to remain in the milk the greater will be the number of organisms passing into the liquid. The process may be understood more clearly by a rough analogy with making a brew of tea. If the tea leaves are removed soon after the addition of the hot water, the tea remains weak. If they are stirred in the teapot, or left for any length of time, the brew becomes much stronger. Similarly, if dust and dirt are left in the milk, undesirable bacteria, with which every particle of dirt is teeming, pass into the milk and increase the tendency to early souring.

The milk from each cow should be removed immediately milking is completed and tipped through the straining disc into the receiving tank above the cooler. It will not require a second or even a third straining, for one straining, together with proper cooling, will be sufficient to give the milk a satisfactory keeping quality.

FEEDING DAIRY CATTLE IN WINTER.

Many farmers conserve enough roughage to last their dairy herds through a severe winter, but few understand why the milkers fail to keep up production. Mastication and digestion of dry roughage use up at least 60 per cent. of the energy value of the feed. With concentrates, less than 20 per cent. is used. It follows that very often on poor quality roughage, a cow is either unwilling or unable to consume enough to meet the requirements of full lactation. The trouble might be met in two ways. Extra consumption can be stimulated by increasing the palatability of the food. Molasses thinned out with water is excellent for this purpose. Bran and other milling by-products also may be used when prices are reasonable.

Seed cake preparations are excellent for dairy cattle. Because of its slightly laxative nature, linseed has found greatest favour. There is a growing tendency to replace vegetable proteins by animal protein. Meat and animal protein meals are used extensively when analyses and prices are sufficiently attractive. By consulting the registered analyses and comparing costs, the farmer can determine which product is the cheapest to buy. All farmers who have overcome the cow's natural dislike for meat and animal protein meals have been amply repaid by the money saved and by the increased production. Under certain conditions, however, it may be uneconomical to feed such concentrates. This is usually the case with poorer milking herds.

The farmer should add a mineral supplement to the ration of all milkers, as well as heavy-in-calf cows. A mixture of two parts sterilised bone meal and one of salt should be kept in a convenient place, or about one eggcupful mixed in each feed. With heavy milkers, the allowance might be doubled.

* * *

MEAT AND BLOOD MEALS.

Meat meals and blood meals sold under a variety of names are rich in digestible protein. A high-class meat meal with a crude protein content of 65 per cent. has about twice the digestible protein of commercial cottonseed or linseed meal. In farming terms, this means that 1 lb. of high-grade meat meal has above the same feeding value as 2 lb. of linseed or cottonseed meal.

The cost of meat or blood meal is not greatly different from that of the vegetable meals, and if they can be conveniently included in the ration of dairy cattle feeding costs will be reduced.

Only dairy cattle which have been consistently underfed take kindly to meat or blood meals. Cattle which have been accustomed to small quantities of these meals from birth also present no difficulty. As a general rule, however, dairy cattle only slowly acquire a liking for concentrates containing meat and blood meals and at first only a few ounces should be included in the regular ration. The amount can be gradually built up to the required level, which will, of course, depend upon the quality and quantity of other foods used. Advice on suitable rations may be obtained from the Department of Agriculture and Stock, but the dairy farmer can usually adjust the concentrates in the ration to conform with the milk yield of the individual cow.

Grain and molasses, grain and salt, milling by-products—such as bran and pollard or such attractive meals as linseed, cottonseed, or cocoanut—may be mixed with the meat and blood meals to attract unwilling cows.

Animals which still refuse to eat these meals may be kept for a short time without any food, other than that offered, if allowed plenty of water. It is important that the feed should be changed night and morning, so that a fresh mixture is always before the cow. If this system appears too drastic the nose-bag method may be used. Freshly-chaffed green maize and the meal are mixed before using, and the contents of the bag should be changed night and morning. Most cattle can be induced to eat meat or blood meals by one or other of these methods.

Both meat and blood meals should be fresh, free from objectionable odour, finely milled, and sterile. An undue greasiness is not detrimental, but, in general, the higher the fat content the less palatable the meal.

Meat meals should show a good analysis. Any preparation with a crude protein content of less than 50 per cent. is not a true meat meal, but a meat and bone meal. Blood meal should show a minimum of 75 per cent. crude protein. It should be almost without smell.

As both meals decompose when allowed to remain in a moist condition they should be stored in a dry place and any excess in the feed boxes should be removed each day. Material which has been "fouled" by moisture soon becomes a source of danger and is then only fit for fertilizing.

DIRT ON THE DISHCLOTH.

Although the necessity for using only brushes for the cleaning of dairy utensils is generally well understood by dairy farmers, instances still come under the notice of field officers where some farmers persist in using cloths for this purpose. Cans washed with cloths which are not kept scrupulously clean, or renewed for each occasion of use, are a potent cause of taints, such as "dish cloth" or "cheesy" flavours, in milk and cream, the flavour becoming noticeable after the cream has been kept for some time, and particularly if it is not delivered to the factory daily.

The use of cloths to wipe cans or utensils dry after washing and scalding or steam-sterilising is also unnecessary; in fact, it only helps to reintroduce bacteria to the cans. If properly scalded or steam-sterilised the heat of the can will cause the immediate evaporation of any remaining moisture.

WHOLESOME MILK.

Normal milk can only be produced by a normally healthy herd, fed on wholesome and non-taint producing fodders. If only one cow in the herd is not in normal health her milk production will be sub-normal, and, if mixed with the milk from the remainder of the herd, the quality of the whole may be seriously affected. Cleanliness should be exercised during the whole process of milking, and all utensils and surroundings kept clean.

If the milk is intended for human consumption, cooling and aerating will allow the feed flavours to be given off, and the reduction in temperature will check bacterial development.

The PIG FARM

Keeping Pigs Healthy.

BY the general practice of hygiene and sanitation in the piggery, coupled with sound feeding methods, the incidence of most pig diseases can be considerably reduced.

Roomy, well ventilated, but draught-proof sties are necessary.

The floors should be swept clean every morning, all refuse being taken away and the yards raked over. Correct drainage of sties and yards will avoid the accumulation of water and help to keep down insanitary conditions.

Moisture is necessary for the free living stages of nearly all worm parasites; in its absence very few of them can survive for any length of time. Therefore, pig keepers who wish to avoid losses from worms must have dry, well-drained sties and yards.

Unhygienic and insanitary conditions are predisposing causes of rheumatism, catarrh, and some of the more serious bacterial infections—such as suppurative otitis and pneumonia. Piggeries should, therefore, be constructed on high ground, floors should be made of concrete, and the run should be well sheltered from inclement weather.

Correct feeding and watering, together with adequate housing and paddocking, are undoubtedly most important factors in the preservation of the health of the pig.

◆

MANGE IN PIGS.

Caused by a minute, worm-like mite which lives in the hair follicles and sweat glands of the skin, the condition described as demodectic mange in pigs is one which the pig-raiser ought to know all about, because its presence sometimes results in the de-grading of carcases, especially of those submitted for export.

The mites are microscopic in size, measuring only one-hundredth of an inch in length.

The lesions of demodectic mange first appear, as a rule, on the snout, eyelids, elbows, and knees. In the initial stages, the areas attacked have a reddened, scurfy appearance with numerous small, hard nodules scattered over them. These become infected with bacteria and begin to ooze pus and serum. The disease gradually spreads over the throat, breast, abdomen, and elsewhere where the skin is soft and thin.

In its early stages, demodectic mange may be checked by frequent applications of crude oil. The disease, however, is very difficult to cope with, and once it appears it is best to get rid of infected animals and to isolate all other animals which have been in contact with them for at least a fortnight. In addition, the sties should be cleaned out thoroughly with boiling water and soda, and then disinfected.

MEATMEAL FOR PIGS.

It is known generally that meatmeal is a good substitute for separated milk in the pig's diet, but unless it is used carefully meatmeal may prove an expensive food.

Meatmeal, which is a by-product of abattoirs and meatworks, is sold under several trade names and some varieties contain a small percentage of bonemeal. It is a wholesome food, convenient to use.

As meatmeal is expensive in comparison with pig foods grown on the farm, it should not be used more freely than is necessary.

Separated milk, which meatmeal replaces, is used according to its availability, pigs sometimes receiving milk as their sole diet, but pigs will thrive on small quantities of milk used in combination with grain and other foods such as pumpkins and sweet potatoes; the milk supplies a part of the protein necessary to balance the ration. Each pig from weaning until baconer stage and each dry sow should receive a minimum of three-quarters of a gallon of separated milk daily, and each sow with a litter double that quantity.

When these minimum quantities of separated milk are not available, meatmeal may be substituted, using about ½ lb. of meatmeal to replace each three-quarters of a gallon of separated milk.

Pigs thrive on a mixture of milk and meatmeal, or meatmeal alone as the protein-rich portion of the diet. The quantities used should not exceed from ¼ to ½ lb. daily per pig from weaning to baconer stage, according as to whether good lucerne is available or not; and ½ lb. for each dry sow and 1 lb. daily for each sow with litter.

By feeding a constant quantity of separated milk or meatmeal, and increasing the grain and other foods according to the pig's appetite, the nutritive ratio is widened automatically as the pig grows and satisfies its requirements.

In cases where pigs have access to good young pasture or green crops, the minimum quantity of separated milk or meatmeal stated above may be reduced by up to 50 per cent., depending on the quality of the green foods.

Meatmeal may be fed dry or mixed with milk or water.

Registered
Hatcheries

Name and Address.	Name of Hatchery.	Breeds Kept.
G. Adler, Tinana	Nevertire ..	White Leghorns, Australorps, Rhode Island Reds, and Langshans
F. J. Akers, Eight Mile Plains ..	Elmsdale ..	Australorps
E. J. Blake, Rosewood	Sunnyville ..	White Leghorns, Australorps, White Wyandottes, and Rhode Island Reds
W. Brown, Waterworks road, Ashgrove	Strathleven ..	White Leghorns
A. F. Buchler, Milman	Pincrow ..	White Leghorns
J. Cameron, Oxley Central ..	Cameron's ..	White Leghorns and Australorps
M. H. Campbell, Albany Creek, Aspley	Mahaca ..	White Leghorns and Australorps
J. E. Caspaney, Kalamia Estate, Ayr	Evlington ..	White Leghorns
J. L. Carrick and Son, Manly road, Tingalpa	Craigard ..	White Leghorns and Australorps
N. Cooper, Zillmere road, Zillmere	Graceville ..	White Leghorns
R. B. Corbett, Woombye ..	Labrena ..	White Leghorns and Australorps
T. G. Crawford, Stratford, via Cairns	Rho-Isled ..	Rhode Island Reds
Dr. W. Crosse, Musgrave road, Sunnybank	Brundholme ..	Australorps, White Leghorns, and Rhode Island Reds
O. M. Dart, Upper Brookfield ..	Woodville ..	Australorps, White Leghorns, Langshans, and Rhode Island Reds
Dixon Bros., Wondecla ..	Dixon Bros. ..	White Leghorns
F. G. Ellis, Old Stanthorpe road, Warwick.	Sunny Corner ..	Australorps
Elks and Sudlow, Beerwah ..	Woodlands ..	White Leghorns and Australorps
B. E. W. Frederich, Oxley road, Corinda	Glen Albyn ..	Australorps
W. H. Gibson, Manly road, Tingalpa	Gibson's ..	Australorps and White Leghorns
Gisler Bros., Wynnum ..	Gisler Bros. ..	White Leghorns
G. Grice, Loch Lomond, via Warwick	Kiama ..	White Leghorns
J. W. Grice, Loch Lomond, via Warwick	Quarrington ..	White Leghorns
Mrs. M. Grillmeier, Mount View, Milman	Mountain View	Australorps, Minorcas, and Rhode Island Reds

Name and Address.	Name of Hatchery.	Breeds Kept.
C. and C. E. Gustafson, Tannymorel	Bellevue ..	Australorps, White Leghorns, and Rhode Island Reds
P. Haseman, Stanley terrace, Taringa	Black and White	Australorps and White Leghorns
C. Hodges, Kuraby	Kuraby ..	White Leghorns and Anconas
H. Hufschmid, Ellison road, Geebung	Meadowbank ..	White Leghorns, Brown Leghorns, Minorcas, Australorps, and Rhode Island Reds
S. W. Kay, Cemetery road, Mackay	Kay's	White Wyandottes, Light Sussex, Rhode Island Reds, Australorps, White and Brown Leghorns
F. W. R. Longwill, Birkdale ..	Nuventure ..	Australorps and White Leghorns
J. McCulloch, Whites road, Manly	Hindes Stud Poultry Farm	White Leghorns, Brown Leghorns, and Australorps
W. S. MacDonald, Box 208, Babinda	Redbird ..	Rhode Island Reds and Anconas
F. McNamara, Vogel road, Brassall, Ipswich	Frammara ..	White Leghorns and Australorps
A. Malvine, junr., The Gap, Ashgrove	Alva	Australorps and White Leghorns
H. L. Marshall, Kenmore ..	Stonehenge ..	Australorps and White Leghorns
W. J. Martin, Pullenvale ..	Pennington ..	Australorps, White Leghorns, and Langshans
C. Mengel, New Lindum road, Wynnum West	Mengels ..	Australorps
J. A. Miller. Racecourse road, Charters Towers	Hillview ..	White Leghorns
F. S. Morrison, Kenmore ..	Dunglass ..	Australorps, White Leghorns, and Brown Leghorns
Mrs. H. I. Mottram, Ibis avenue, Deagon	Kenwood Electric	White Leghorns
J. W. Moule, Kureen	Kureen ..	Australorps and White Leghorns
D. J. Murphy, Marmor ..	Ferndale ..	White Leghorns, Brown Leghorns, Australorps, Light Sussex, and Silver Campines
S. V. Norup, Beaudesert rd., Cooper's Plains	Norups ..	White Leghorns and Australorps
H. W. and C. E. E. Olsen, Marmor	Squaredeal ..	White Leghorns, Black Leghorns, Australorps, Brown Leghorns, and Anconas
A. C. Pearce, Marlborough ..	Marlborough Stud Poultry Farm	Australorps, Langshans, Rhode Island Reds, Light Sussex, White Wyandottes, Khaki Campbell Ducks, Indian Runner Ducks, and Bronze Turkeys
E. K. Pennefather, Douglas street, Oxley Central ..	Pennefathers ..	White Leghorns and Australorps
G. Pitt, Box 132, Bundaberg ..	Pitt's Poultry Breeding Farm	White Leghorns, Brown Leghorns, Australorps, Langshans, White Wyandottes, Rhode Island Reds
G. R. Rawson, Mains road, Sunnybank	Rawson's ..	Australorps
J. Richards, Atherton	Mount View ..	White Leghorns and Australorps
H. K. Roach, Wyandra ..	Lum Burra ..	Australorps and White Leghorns
C. L. Schlencker, Handford road, Zillmere	Windyridge ..	White Leghorns
S. E. Searle, New Cleveland road, Tingalpa	Tingalpa ..	White Leghorns and Australorps
A. Smith, Beerwah	Endcliffe ..	White Leghorns and Australorps
A. T. Smith, Waterworks road, Ashgrove	Smith's ..	Australorps and White Leghorns
T. Smith, Isis Junction	Fairview ..	White Leghorns and Langshans
H. A. Springall, Progress street, Tingalpa	Springfield ..	White Leghorns

Name and Address.	Name of Hatchery.	Breeds Kept.
J. Steckelbruck, The Gap, Ashgrove	Cosy Nook ..	White Leghorns and Australorps
A. G. Teitzel, West street, Aitkenvale, Townsville	Crescent ..	White Leghorns
W. J. B. Tonkin, Parkhurst, North Rockhampton	Tonkins' ..	White Leghorns and Australorps
P. and K. Walsh, Cleveland ..	Pinkland's ..	White Leghorns
W. A. Watson, Box 365 P.O., Cairns	Hillview ..	White Leghorns
G. A. C. Weaver, Atherton ..	Weaver's ..	Australorps, White Leghorns, Buff Leghorns, Wyandottes, Anconas, Indian Game, Rhode Island Reds, Barred Rocks, Buff and Black Orpingtons
H. M. Witty, Kuraby ..	..	White Leghorns and Australorps
P. A. Wright, Laidley ..	Chillowdeane ..	White Leghorns, Brown Leghorns, and Australorps
R. H. Young, Box 18, Babinda	Reg. Young's ..	White Leghorns, Australorps, and Brown Leghorns

Following is a list of new registrations received up to the 21st May, 1940:—

B. Cross, Apple Tree Creek, Childers	Spring Hill ..	White Leghorns, Australorps, and Langshans
W. Easson, Formosa road, Tingalpa	Grassdale ..	White Leghorns and Anconas

THE CHICKEN SEASON.

A large proportion of the chickens which will be hatched during the coming spring will be culled at various stages of growth, as being unsuitable for production in the future. Some of the culling may be necessary because of the parentage of the individual, but by far the greater number of culls will be due to the lack of care, attention, and feeding.

Because of the high cost of poultry food, the improper feeding of the chickens, particularly during the early days of life, is likely to be responsible for a greater percentage of culls than any other cause. Foods that are most suitable for chickens during this period are relatively costly, and efforts may be made by many to economise by substituting foods which, while they might prove satisfactory for older stock, are not entirely suited for the growth of young chickens.

Economic production is only possible from the well-grown, well-fed, and well-bred birds; consequently, it is essential to give the layer of the future a good start in life. When it is considered that growing chickens, during the first six or eight weeks, do not consume very large quantities of food, the saving that may be made by the cheapening of the ration does not reduce the first costs to any material extent.

The following table indicates the reasonable weekly food consumption for chickens of two of the most popular breeds, and the average weight that chickens might be expected to be at these periods:—

TABLE SHOWING WEEKLY FOOD CONSUMPTION AND WEIGHT OF CHICKENS.

Week.	Leghorns.		Australorps.	
	Food Consumed, in oz.	Weight of Chick.	Food Consumed, in oz.	Weight of Chick.
First	1·64	1·97	1·53	2·14
Second	3·36	3·31	3·32	3·61
Third	4·80	5·31	5·05	5·84
Fourth	6·46	7·61	7·20	8·68
Fifth	7·58	9·94	6·89	12·08
Sixth	8·96	12·92	10·62	15·86
Seventh	8·65	16·65	13·95	20·17
Eighth	13·29	20·41	15·05	25·31
Total	54·74	..	63·61	..

Pounds food consumed per 100 chicks in 8 weeks—Leghorns, 342 ; Australorps, 398.

The above table indicates that it takes about 350 lb. of food per 100 to rear White Leghorn chicks to the age of eight weeks and approximately 400 lb. of food to rear Australorps to the same age. The saving of 2s. or 3s. per 100 lb. consequently makes very little difference to the cost, but it may materially and adversely affect the growth that is desired. In nutritional experiments that have been conducted at the Animal Health Station, the following rations have given most satisfactory results:—

Ration.	1–8 Weeks.	8 Weeks to Maturity.
	Lb.	Lb.
Maize Meal	40	63
Bran	20	13½
Pollard	20	13½
Meat and Bone Meal	7½	5
Dried Buttermilk	10½	3½
Salt	1	1
Cod Liver Oil	1	1
Lucerne Meal	..	2½
Crude Protein Content	17·15%	14·40%

To those who mix their own rations, a mash containing the abovementioned ingredients is recommended. Those who prefer to buy a prepared mash should purchase none but mashes which have been made expressly for the purpose of feeding chickens and growing stock.

* * *

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Agricultural Notes

The Sweet Potato.

THE sweet potato is not cultivated in Queensland to-day to the extent that its usefulness warrants.

When questioned about the shortage of sweet potatoes for table use, the farmer usually replies, "There is no demand for them." This is true only in part, but the demand still exists for the right varieties. A dry floury, or a moderately moist potato, will suit the consumer best. No doubt, some of the good varieties in use in the past are not now available, owing to droughts and irregular planting, but many are still to be found in certain localities. If the planting is confined to varieties which have proved popular with the consumer, and which could be sold on name, the demand for them should be continuous. Under present conditions a householder may buy sweet potatoes which are unpalatable. If, however, consumers realised that there were different types and varieties of sweet potatoes, they would learn very soon to purchase only types which they like.

Market gardeners might, therefore, cultivate varieties for which they could readily find buyers. Some market gardeners are already doing this with good results. Very watery or stringy varieties are both undesirable. It is a mistake for a grower to allow a portion of his crop to stand over after maturing, as the tubers then begin to deteriorate in quality.

Sweet potatoes are easy to grow, and can be raised on a variety of soils, the period of growth from planting to harvesting being approximately three months. The period of planting is dependent very largely on the locality; in most parts along the coast it may extend from October until the end of February. The crop must mature before the frost commences. The crop does not require a big rainfall—in fact, excessive moisture is detrimental to good results, in that it increases the growth of vines, and lessens the crops of tubers.

The most satisfactory method is to plant a few medium-sized tubers in a nursery bed of good friable soil, which is mulched in order to retain moisture and promote rapid growth, and to pick cuttings as growth progresses. A bed of fifty selected tubers planted in this way will provide many thousands of cuttings. The alternative, and less satisfactory, method of obtaining planting material is to procure cuttings from an old plot, which is usually neglected. The terminal cutting from the vine is generally regarded as giving the best results. The land is set up in ridges 3 feet apart. The cuttings should be 12 to 15 inches in length, and planted on the ridge to a depth of approximately 6 inches, cuttings to be set from 20 to 24 inches apart. On well-prepared soil weeds should not be troublesome, and little attention will be necessary until harvesting.

A good crop of sweet potatoes will yield 20 tons of tubers to the acre. Several of the old varieties were known by different names in various districts. A classification of all varieties grown in Australia was carried out in recent years by an officer of the Department of Agriculture and Stock, and cuttings of a known type, together with a number of new seedling varieties, were distributed in different agricultural districts of the State. Some recommended varieties for planting for table use are Gold Coin, Seedling No. 3, Brook's Gem, and Snow Queen.

It is advantageous to the grower to market the tubers in a clean and attractive condition.

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PROTECT THE POTATO CROP AGAINST IRISH BLIGHT.

Irish blight is a disease which is well known to most experienced potato and tomato growers. Black, water-soaked areas of decay make their appearance on leaves and stalks during cool, showery weather. These will become dry and papery if there is a dry change, but when rain or misty weather continues the disease will rapidly spread until the whole of the foliage becomes blighted and the plant dies to the ground. The disease may pass down the underground stems and infect the tubers, or these may be infected direct through exposed surfaces before or after digging. The symptoms in the tuber consist of a sunken and darkened condition of the skin, beneath which is a varying area of brown decay extending into the flesh. When stored under moist conditions, affected tubers may rot completely.

The development of this disease is closely bound up with weather conditions. The causal agent is a fungus which, in Queensland, is unable to grow during the warm summer months. Hence, blight only appears during the late autumn, winter, and spring. The fungus is also dependent on moist, showery weather for the production of its delicate spores and its rapid development and spread. It is for this reason that the disease is sporadic in its appearance, and varies in severity with the nature of the season.

The fact that Irish blight is not serious every year tends to make many farmers somewhat lax in regard to doing anything for the control of the disease. There is, however, a definite risk attached to this attitude, and potato growers are strongly advised to give serious attention to the control measures outlined below.

Spray the plants thoroughly with Bordeaux mixture. Commence when the plants are young, before the disease becomes well established, and repeat the application during the growth of the crop so as to keep the foliage well covered. About three applications during a dry season and five during a wet one are usually sufficient. Plants should not be sprayed when they are wilting from want of water, as some spray burn may result.

The spray should be made up at the strength of 4 lb. bluestone and 4 lb. hydrated lime to 40 gallons of water. Approximately 150 gallons of spray are required for 1 acre of fair-sized plants. Spraying can be carried out with a knapsack pump, but a larger outfit, such as a barrel pump, is more convenient for treating large areas. Directions for preparing Bordeaux mixture may be obtained on application to the Department of Agriculture and Stock.

◆

FARM WATER SUPPLY.

It is extremely important that the supply of water on the dairy farm should be of pure quality and sufficient for requirements. Many farmers fail to realise that a contaminated water, if used for washing the cows' udders, the hands of the milker, or the utensils, may result in dangerous bacterial infection of the milk or cream. If cows and other stock are allowed access to foul or polluted water, not only will they wade, collecting unclean bacteria on the coat and udder, but they will drink it if a good fresh and pure supply is not available in adequate quantity, and in this way the spread of disease will be increased. The average milking cow is estimated to need 12-15 gallons of drinking water daily—this amount may not be sufficient in summer or in the case of heavy milkers—and experiments have proved that where cows have been allowed unlimited fresh drinking water, the milk yield has shown an increase.

Deep well water, provided it is not heavily mineralised, is the most satisfactory type of supply, for coming from far below the surface it is usually very pure and has the advantage of a low temperature all the year round. This is especially useful for cooling purposes in the dairy.

Shallow wells may yield a good quantity of water which is usually soft, but it is frequently impure owing to its proximity to the surface; surface rain water cannot receive sufficient filtration through the soil layers by the time it reaches the shallow well level to free it completely from contamination. Pollution from surface drainage is commonly found in shallow well water, but this does not mean that it cannot be made use of on the dairy farm. It does mean, however, that either chemical sterilization or boiling must be resorted to in order to purify it.

Tank water is the most common form of supply on Queensland farms, and in comparatively dust-free areas this water may be of a high standard of purity, but this is not always so, for where much dust settles on roofs or after a dry spell, the water is bound to wash off a great deal of sediment and with it undesirable bacteria. This applies especially to tanks attached to the milking bails, for water collected from these roofs is liable to be contaminated with manure dust and particles blown from the stock yard, making it unsuitable without treatment for dairy purposes. The practice of rinsing clean cans on their return from the factory with such cold, untreated water has been known to contaminate them seriously; instead they should be thoroughly scalded out with boiling water and allowed to drain dry.

Farm water treatment must be simple and cheap, and two methods are recommended.

(1) *Boiling.*—For washing dairy utensils, the water must be pure, and boiling is the simplest method of purifying a suspected supply. If water is brought up to the boil (210 deg. to 212 deg. F.)

the bacteria causing ropiness and other faults will be destroyed, together with coliform (dung) types and disease organisms. Every farmer should provide himself with a dairy thermometer so that he can check temperatures, for the correct heating of water and utensils and cooling of milk and cream are essentials in successful dairy management.

(2) *Chlorination.*—Sterilization of water by means of some chlorine compound is quite satisfactory provided the right amount is used. A quantity giving 1 *part of chlorine in* 2,000,000 *parts of water* will sterilize any ordinary supply, leaving no excess. Where cloudiness or sediment are present, as may be the case if tanks are not cleaned, or with shallow well water, a larger amount of the compound may be needed than with a clear water, but care must be taken not to overdose with this powerful chemical since any excess will cause a bad taint in milk and cream. Addition of the chemical to water in the tank once a week, and after rain, should serve to keep the supply in good condition.

The periodic cleaning out of all water tanks is essential to maintaining a pure supply, and should not be neglected.

GROW MORE FODDER CROPS.

Every year, producers in the Maranoa and Western Darling Downs districts are confronted with the difficulty of maintaining the condition of stock during the winter months, when pastures are short and harsh. There is only one way out, and that is to take advantage of the better types of soil available and grow fodder crops—not in a haphazard, casual way, but by using a system by which land is given a fallow period prior to the planting of each crop.

The recent bountiful rains throughout these districts provided an opportunity for making a commencement with a fodder programme, and, in view of the erratic seasonal conditions usually encountered, every advantage should be taken of the moisture now in the ground. Many settlers have winter crops—such as wheat, oats, or barley—germinating now, and an excellent practice, particularly after the heavy rains experienced, is to give the crop a light harrowing as soon as the plants have a good hold in the soil. This should be done at right angles to the direction of sowing to check weed growth, prevent evaporation, and give plants a better chance to stool.

Following planting and harrowing, attention should be given to land intended for summer fodders such as Sudan grass, sorghums, Japanese millet, and cowpeas. There is every temptation to utilise every acre of available cultivation for sowing winter crops. In the very rare years when good winters are experienced, plough and plant methods may work out to some advantage, but far better results, on the average, will be obtained if a systemised cropping programme—including rotation of crops and fallowing—is adopted. Wherever possible, therefore, land which has not been prepared for winter crops should be ploughed and left in the rough state for early spring planting. In this way, moisture at present in the ground will be retained, and even light rains in spring will permit planting at that time. Apart from moisture conservation, the aeration of soil by fallowing oxidises plant foods and makes them more readily available to the growing crop.

Horticultural Notes

Some Tropical Fruits.

THE WOOLMI.

S. E. STEPHENS, Northern Instructor in Fruit Culture.

THIS fruit is one of the most popular and most widely used of the native fruits of North Queensland. Botanically it is known as *Antidesma dallachyanum,* the specific name commemorating Mr. J. Dallachy, an early day naturalist of North Queensland, by whom it was first collected. It belongs to the family Euphorbiaceae. The common name ''Woolmi'' which is used here is the name given to the fruit by the aborigines of the Rockingham Bay district, where it was first discovered. This name appeals as being more applicable than the names ''Wild Cherry'' or ''Herbert River Cherry'' frequently used.

The Woolmi is a small tree, seldom growing more than 25 feet high. Under natural conditions it occurs on the fringes of the rain forests, or close to the banks of creeks or lagoons, in parts of the North Queensland coast, where the rainfall is not so heavy as that of the wettest regions. It appears to have a preference for a well-drained alluvial soil. As a garden tree it is of shapely habit, but, under conditions of natural growth, it is frequently ragged in shape and spindly of growth by reason of the smothering effect of taller growing trees overshadowing it. The foliage is very deep green on the upper surface, and bright green on the lower surface of the leaves. Young leaves are only slightly pubescent and the mature foliage is almost or quite glabrous. The leaf is rather thick and leathery to the touch.

The fruit is sometimes solitary, but is more frequently in clusters of four or more on racemes 3 or 4 inches in length. The individual fruits vary from about ½ to 1 inch in diameter, and from cream with a rose red cheek to a dark purple red in colour when ripe. Both size and colour vary on different trees. The darker coloured fruit is usually more luscious and sweeter than the light coloured fruit.

The seed is small, 3/16 inch to ¼ inch in diameter, with a thick, hard shell. It germinates readily in the seed-bed in eight to ten weeks. The young seedlings may be transplanted without difficulty. Growth is fairly vigorous, and by the time the young tree commences to bear at about six years of age, it will have reached a height of about 8 feet. Sometimes two crops are borne in a season, but one is the usual setting. The trees blossom for the main crop during December, January, and February. The flowers are borne numerously in racemes which arise chiefly from spurs on the smaller branches and twigs. About forty minute greenish flowers are contained in a spike. Fruit from this flowering is ripe between April and late July, some trees being early maturing, others late. The secondary crop is produced from a small flowering in September, and is ripe at the time the trees are in bloom for the main crop.

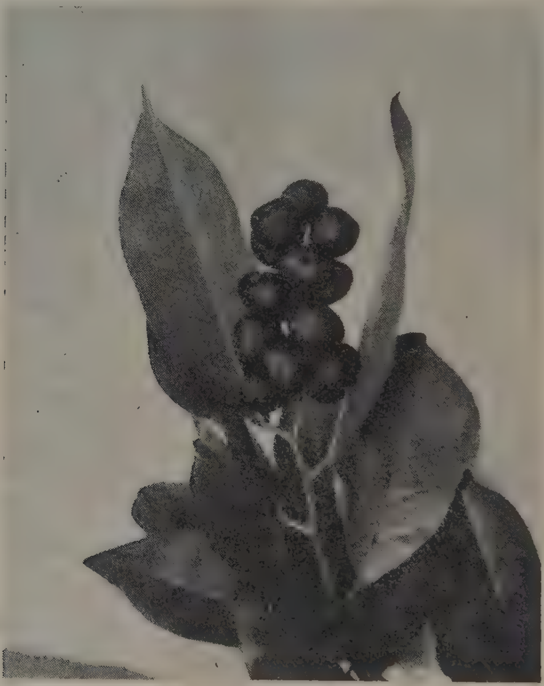

Plate 153.
THE WOOLMI (Stephens).

The fruit may be eaten fresh, but is more frequently used in preserves. Following are some of its uses:—

Woolmi Conserve.—Place the fruit in a preserving-pan and barely cover with water. Boil until the fruit is tender (about a quarter of an hour). Then add one cup of sugar for each cup of fruit and boil until it jellies. Short boiling before the sugar is added produces a conserve of light colour with tender, transparent fruit. Long first boiling makes the fruit tough and the finished product dark in colour.

Woolmi Sauce.—Six lb. woolmi, 1 lb. light brown sugar, 2 lb. vinegar, 1 teaspoon cayenne pepper, ½ tablespoon salt, ½ oz. cloves, ½ oz. allspice, small handful white ginger, well bruised. Put all the ingredients into a preserving-pan and bring slowly to the boil. Boil well and then strain through a colander. Bottle when cold and seal airtight.

Woolmi Wine.—Put about 6 quarts of ripe cherries in a dish and cover with boiling water. Set aside for eight to ten days, stirring the fruit well each day. Then strain and add sufficient water to make 1 gallon of liquid. Add 4 lb. sugar, and, when dissolved, bottle the liquor and tie a piece of muslin over the mouth of each bottle. Put aside in a cool, shady place, and after three months cork the bottles. The wine improves with keeping.

TOMATOES IN FROST-FREE AREAS.

The tomato does well on several types of soils in the North and South Coast districts provided they are well drained, although a rich loamy soil is preferable. The plants should be well supplied with plant foods, but should not be too liberally treated with nitrogen, which will tend to produce a large plant throwing late fruit. Fertilizers should be rich in phosphoric acid and potash, with just sufficient nitrogen to produce a good but not over-luxuriant growth. A complete fertilizer can be made up as follows:—

420 lb.	Sulphate of ammonia
700 lb.	Superphosphate
560 lb.	Bonedust
560 lb.	Sulphate of potash
2,240 lb.	(used at the rate of from 3 to 5 cwt. per acre).

The method of planting will be determined by the system of training to be adopted. Where trellising or staking is to be practised, the rows may be 3 feet apart, and the plants in the rows from 15 to 18 inches apart. The rows should, if possible, run north and south. When not staked or trellised, the rows require to be at least 4 to 6 feet apart and the plants 4 feet apart in the rows.

The tomatoes may be trained on a trellis or staked. In the latter instance, stakes 5 feet long are driven into the ground alongside each plant when they are about 1 foot in height. As the plant grows, the lateral growth produced from the axils of the leaves is removed. Further growth is thus limited to single or double stems, which are tied to the stakes at intervals.

Pruning tends to promote the formation of flower clusters and the setting of fruit. When several flower clusters have been produced, the leader or leaders are checked at one or two leaves above the last flower cluster.

The plants should receive regular attention, and lateral growth should be restrained until it is time to check the leaders. In this way the energies of the plants are directed towards the growth and maturing of the fruits and the tendency to shed first blossoms and fruit is reduced.

Trellising or staking, together with pruning, permits the maximum amount of light and air to reach the plants, thus decreasing their susceptibility to disease.

MARKETING CAULIFLOWERS.

Cutting.—There should be no difficulty in marketing cauliflowers to the best advantage. The main stalk is cut a short distance below the base of the leaf stalks. This short length of stalk gives protection and prevents the leaves from breaking away. All first quality cauliflowers should be marketed with the leaves intact, as this prevents the heart from being damaged in transit.

Containers.—A clean chaff sack is the best container, being light and airy. Corn sacks, unless new, are usually unsuitable.

Packing.—The cauliflowers should be packed with the leaves brought together to protect the heart. This assists in preventing bruising and discoloration, keeping the heart white and attractive and in a fit condition to sell at high values.

Grading.—First and second quality cauliflowers should be packed separately. Each bag should contain as near as possible cauliflowers of the same size and quality. Mixed sizes do not sell as well as graded. Any cauliflowers showing leaf damage should be packed as second grade.

Branding.—Where possible, markings should be placed on the bags before filling. Stencils suitable for doing this are easily procured, and save time. The grower's name, or mark, and the number of cauliflowers in the bag should be conspicuously placed on the side of the bag. This makes identification easy, and often saves unnecessary handling.

Packed bags should not be used as a seat when carting cauliflowers.

SELECTING NEW BANANA AREAS.

With the coming of winter, intending banana-growers would be well advised to give serious consideration to the selection of the areas shortly to be felled for the 1940 planting.

Of late years, bananas have been grown extensively and fairly successfully on inferior forest country, but, in most instances, a suitable aspect, assisted by good cultural methods, has been the chief factor in success.

The best aspect, of course, is the north-east or northerly slope, with standing timber on all four sides to give the necessary shelter from strong winds, and these aspects ensure the maximum amount of winter sunshine.

With sites facing any further into the east than north-east, great care should be taken that, as far as possible, the area is sheltered from the cold south-east winds. An efficient breakwind on the south side of an easterly patch should, therefore, be provided for in the clearing plan. The site chosen should be so situated that tall timber or hills at the top of the proposed area will not shut out the winter sun at an early hour.

A north-westerly slope is preferable to south-east, south, or south-westerly slopes, if heavy belts of timber block the strong westerly winds. Many good bananas have been grown on westerly slopes of this description, chiefly because the areas in question receive the sun during the whole of the afternoon.

All southerly slopes should be definitely avoided, more particularly if there is open country for any distance around the proposed area. Much more timber will have to be felled than actually required for planting, to obviate the long shadows which standing timber at all close to the patch throw over the plantation. The limited period during which they are exposed to the sun is the chief objection to all southerly slopes.

A good warm-slope plantation will produce from two to three bunches to every one on the cold-slope areas. Production costs, particularly to the grower on leased ground, enter so largely into the picture that intending growers with a choice of ground should always choose a warm situation to gain the best results.

TENDING BANANAS AFTER RAIN.

After the monsoonal rains of the late summer, banana plantations will commonly be very dirty with weeds and, consequently, growers will then have to set about generally cleaning up their areas. Furthermore, the heavy rains will have had a leaching action on soils, particularly those of a porous nature on hillsides, and soils low in soil organic matter, and it is therefore wise also to give a dressing of fertilizer at this cleaning up time. In the October, 1939, number of *The Queensland Agricultural Journal* there appeared an article dealing with the root distribution of the banana. This article included a number of diagrams and photographs which showed very clearly that the roots of the typical banana plant are much more extensive, and penetrate the soil to a greater depth than is commonly supposed. One example shows, in the absence of a clay subsoil, a large number of roots more than 4 feet from the base of the plant and 12 to 18 inches below the surface. The other examples make it clear that the depth to which the roots will penetrate depends very largely on the depth to which the soil overlies any clay or other impervious subsoil. Taking into account this and other information given in the article referred to, it is obvious that unless the soil is a very shallow one overlying an impervious subsoil, it is advantageous to chip weeds deeply, and so ensure the destruction of the weeds and, at the same time, influence the roots of the banana to penetrate more deeply into the soil. The mere shaving of weeds at the surface of the soil or but slightly deeper is not really efficient and should be avoided.

The data given in the article shows that the roots of the banana will extend to at least 5 feet laterally from the corm, and from this it can be appreciated that when fertilizer is being applied it is advisable to broadcast it over most of the plantation and not to confine its spread to a small area close to the plant. When small suckers are to be fostered, it may, of course, be beneficial to throw a little extra material fairly close to their base.

WINTER ACTIVITIES IN THE ORCHARD.

Clean up all orchards and vineyards, destroy all weeds and rubbish around the trees likely to harbour pests of any kind, and keep the surface of the soil well stirred, so as to give the birds and predacious insects every chance to destroy any fruit fly pupæ which may be harbouring in the soil. If this is done, many pests that would otherwise find shelter and thus be able to live through the winter will be exposed to both natural enemies and cold.

Pruning may be started on fruit trees which have shed their leaves, as it is a good plan to get this through as early in the season as possible instead of putting it off until spring. Early-pruned trees develop their buds better than those pruned late in the season. These remarks refer to trees—not vines. The later vines are pruned in the season the better in the Stanthorpe district, as the late-pruned vines stand a better chance of escaping injury by late spring frosts. All worthless, badly-diseased, or worn-out trees which are no longer profitable, and which are not worth working over, should be taken out and burnt, as they are both valueless and a harbour for pests.

Land intended for new orchards should be got ready soon and its preparation should be thorough. All stumps and roots should be removed to a depth sufficient to ensure their not impeding cultivation. The preliminary cultivation should consist of a light ploughing of a depth sufficient to turn the weeds or grasses so that their roots are exposed, followed by cross ploughing and harrowing, whereby light roots, &c., are collected and removed. When perennial weeds, of which couch grass is a fair sample, are eliminated, the land should be ploughed and cross ploughed as deeply as possible, and the soil reduced to a fine tilth. Where subsoiling can be practised, it is a decided advantage in admitting root penetration and conservation of moisture.

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THE WALNUT.

Walnut trees grow well in the cooler parts of Queensland where there is a plentiful water supply and deep and well-drained soil. The trees are ornamental and shady, and there is a good demand for the nuts. The trees should be planted in August or September about 30 feet apart. For a few years after planting, all the training necessary is to cut out crossing limbs and to top the most vigorous shoots in order to form a well-balanced tree; subsequently little pruning is necessary. Seedlings may be raised in a nursery bed and planted out when twelve months old, but as these may take many years to come into bearing and may not bear large crops of good nuts, it is more satisfactory to buy worked trees of tested varieties (Wilson's Wonder, Freshford Gem, and Franquette are recommended). The nuts fall to the ground when ripe, and to prevent losses by rotting should be gathered frequently and properly dried before bagging. Nuts to be used for seed should be gathered as soon as they have fallen from the tree, and soaked in water for a week just before planting. The best time to plant the seed is about the middle of July.

The Fruit Market.

JAS. H. GREGORY, Instructor in Fruit Packing.

WINTRY conditions have slowed up fruit consumption. Prices are being affected to a small degree, but the usual tendency is a slow rise after any substantial fall. With the coming of cooler weather, tropical fruitgrowers are advised to be more careful in the matter of the maturity of their market consignments. Fruit should be left to develop to greater degree of ripeness. Pineapples, papaws, and custard apples intended for the Southern markets are difficult to ripen satisfactorily at any time, but during the southern winter it is practically impossible to ripen backward fruit satisfactorily. Growers take no risk by allowing their fruit to develop before consignment. At present, far too much green fruit, especially papaws, is under offer. Citrus growers, too, are inclined to take similar market risks, and prices fell sharply after early consignments were received. At the time of writing, however, orange prices were improving. Strawberries are coming on to the market, and the demand for good quality fruit is strong. The quality of apples has much improved.

Average prices for May were:—

TROPICAL FRUITS.

Bananas.

Brisbane.—Cavendish: Smalls, 12s. 6d. to 20s.; Sixes, 18s. to 22s.; Sevens, 18s. 6d. to 23s. 6d.; Eights, 22s. to 24s.; Nines, to 24s. 6d.

Bunch bananas, 1½d. to 9½d. dozen.

Lady Fingers, 3d. to 8½d. dozen.

Sydney.—Cavendish: Sixes, 12s. to 22s.; Sevens, 22s. to 26s.; Eights and Nines, 25s. to 28s.; prices showing a tendency to ease.

Melbourne.—Cavendish: Sixes, 18s. to 21s.; Sevens, 21s. to 23s.

Newcastle.—Cavendish: Sixes, 22s. to 23s.; Sevens, 24s. to 25s.; Eights and Nines, 26s. to 29s.

Adelaide.—Cavendish: 25s. to 34s. per tropical case.

Pineapples.

Brisbane.—Smoothleaf, 4s. to 8s.; specials, to 8s. case; 1s. 6d. to 6s. per dozen. Roughs: 4s. to 7s. per case; 1s. to 3s. dozen.

Sydney.—7s. to 12s.

Melbourne.—9s. to 12s.; specials, to 14s.

Adelaide.—17s. to 19s.

Newcastle.—9s. to 13s.

Papaws.

Brisbane.—Yarwun, 6s. to 9s. tropical case; Gunalda, 3s. to 5s. bushel; Locals, 2s. to 3s. bushel.

Sydney.—8s. to 15s. tropical case.

Melbourne.—10s. to 14s.; special ripe, higher.

Newcastle.—10s. to 12s.

Custard Apples.

Brisbane.—3s. to 4s. half-bushel.

Sydney.—3s. to 8s. half-bushel.

Melbourne.—7s. to 10s. half-bushel.

Monstera Deliciosa.

Brisbane.—3s. to 4s. dozen; demand slow.

CITRUS FRUITS.

Oranges.

Brisbane.—Navels, 7s. to 10s.; Commons, 4s. to 7s. bushel.

Mandarins.

Brisbane.—Emperor, 3s. to 8s.; Glens, 6s. to 10s.; Scarlets, 5s. to 7s.; Fewtrell, 3s. to 6s.

Sydney.—Queensland Emperor, 6s. to 9s.; Glens, 10s. to 13s.

Melbourne.—Queensland Emperor, 8s. to 10s.; Glens, 10s. to 13s.

Lemons.

Brisbane.—4s. to 6s.; specials, to 11s. bushel.

Sydney.—10s. to 14s.

Melbourne.—10s. to 16s. bushel.

Grape Fruit.

Brisbane.—5s. to 8s. bushel.

Sydney.—5s. to 10s. bushel.

Melbourne.—6s. to 12s. bushel.

Tomatoes.

Brisbane.—Ripe and coloured: 6s. to 8s.; small sizes, lower; Green: 3s. to 5s.; slow of sale.

OTHER FRUITS.

Passion Fruit.

Brisbane.—9s. to 11s.; second grade, 6s. to 7s. half-bushel.

Sydney.—8s. to 10s. half-bushel.

Melbourne.—6s. to 12s. half-bushel.

Avocadoes.

Brisbane.—5s. to 7s. half-bushel.

Sydney.—7s. to 10s. half-bushel.

Melbourne.—8s. to 10s. half-bushel.

Rosellas.

Brisbane.—2s. to 3s. 6d. sugar-bag.

Ginger.

Melbourne.—6d. to 7d. lb.

DECIDUOUS FRUITS.

Apples.

Brisbane.—Jonathan, 8s. to 10s.; Granny Smith, 10s. to 13s.; Cleopatra, 6s. to 9s.; French Crab, 6s. to 8s.; Delicious, 8s. to 11s.; Scarlets, 6s. to 8s.

Pears.

Brisbane.—Beune Anjou, 8s. to 9s.; Glou Morceau, 8s. to 11s.; Packham's Triumph, 6s. to 9s.; Winter Cole, 9s. to 13s.; Winter Nelis, 8s. to 11s.

VEGETABLES (Brisbane prices unless otherwise stated).

Cabbages.—3s. to 5s. dozen; small, lower.

Cauliflowers.—Prime, 7s. to 11s. dozen; others, 2s. to 6s. dozen.

Beans.—Brisbane, 2s. to 8s. sugar-bag; Sydney, 5s. to 8s. bushel; Melbourne, 7d. to 8d. lb.; Newcastle, 5s. to 7s. bushel.

Peas.—Brisbane, 5s. to 10s. sugar-bag; Melbourne, 4d. to 6d. lb.

Pumpkins.—Brisbane, 4s. to 5s. bag; Sydney, 4s. to 8s. bag; Melbourne, £9 to £10 ton.

Lettuce.—6d. to 1s. 6d. dozen.

Rhubarb.—1s. to 1s. 6d. bundle.

Beetroot.—3d. to 9d. bundle.

Carrots.—3d. to 1s. bundle.

Parsnips.—6d. to 1s. 6d. bundle.

Chokos.—3d. to 9d. dozen.

Marrows.—1s. to 4s. dozen.

South Australian Celery.—14s. to 17s. crate.

Local Celery.—1s. to 2s. bundle.

English Potatoes.—4s. to 6s. sugar-bag.

POTATO GRADE.

Grade standards for potatoes were issued a few months ago by Regulation under "*The Fruit and Vegetables Acts,* 1927 *to* 1935." An additional grade has been approved as follows:—

> "New" potato grade shall consist of potatoes which comply with the standard of No. 1 grade, except that they shall not have a mature skin, and shall be not less than 3½ oz. in weight.

No. 1 grade, mentioned above, is as follows:—

> No. 1 grade shall consist of sound potatoes which shall have similar varietal characteristics and a mature skin; they shall be reasonably free from second growth, decay, mechanical injury, and greening from exposure, dirt, and other foreign matter, and from damage caused by disease, sunburn, or insects, and shall be not less than 3 oz. in weight.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Books of the Australian Illawarra Shorthorn Society, and the Jersey Cattle Society, production charts for which were compiled during the month of April, 1940 (273 days unless otherwise stated).

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
MATURE COW (STANDARD, 350 LB.)				
Model 2nd of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	16,531·9	732·233	Reward of Fairfield
Boah Peak Melba (242 days)	Mrs. E. E. Bruggemann, Boah Peak, Silverleigh	10,791·85	443·554	Glenroy Royal
Navillus Vera 5th	C. O'Sullivan, Navillus, Ascot, Greenmount	9,747·5	371·811	Alfa Vale Re Nell
SENIOR, 4 YEARS (STANDARD, 330 LB.).				
Navillus Violet 4th	C. O'Sullivan, Navillus, Ascot, Greenmount	9,528·2	428·234	Alfa Vale Re Nell
SENIOR, 3 YEARS (STANDARD, 290 LB.).				
Gem 7th of Alpha Vale (365 days)	W. H. Thompson, Alfa Vale, Nanango	14,649·7	721·232	Alfa Vale Red Prince
Alva Glen Pet.	G. H. Knowles, Alva Glen, Nanango	10,780·35	413·47	Master of Cedar Grove
JUNIOR, 3 YEARS (STANDARD, 270 LB.).				
Trevor Hill Picture (193 days)	W. Henschell, Yarranvale, Pittsworth	8,659·36	350·94	North Glen Emblem
SENIOR, 2 YEARS (STANDARD, 250 LB.).				
Gem 10th of Alfa Vale	W. H. Thompson, Alfa Vale, Nanango	14,246·25	540·764	Reward of Fairfield
Ehlma Park Pearlie (229 days)	N. Bidstrup, Ehlma, Warra	6,904·56	349·308	Alfa Vale Peter
Ehlma Park Mona	N. Bidstrup, Warra	8,061·62	322·388	Mount Blow Monash
Rhodesview Nancy 23rd	W. Gierke and Sons, Rhodesview, Helidon	7,641·78	308·328	Rhodesview Red Knight
Highfields Beauty 4th	J. A. Heading, Highfields, Murgon	7,537·65	284·447	Greyleigh Legend
Ashstead Fancy	H. Seiler, Redbank Creek, Gatton	6,375·96	260·794	Mountain Home Blossom's Royal
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Alva Glen Maiden	M. Bishop, Glengowrie, Maidenwell	9,411·25	413·358	Cedar Grove Master
Oakvale Red Mona	C. O'Sullivan, Navillus, Ascot, Greenmount	7,727·3	347·44	Chatham of Raleigh
Blacklands Fairy 21st	A. Pickels, Wondai	7,136·25	316·393	Sultan 2nd of Blacklands
JERSEY.				
SENIOR, 2 YEARS (STANDARD, 250 LB.).				
Lermont Kitty	J. Schull, Lermont, Oakey	7,955·75	437·028	Woodside Golden Volunteer
JUNIOR, 2 YEARS (STANDARD, 230 LB.).				
Lermont Golden Kate	J. Schull, Lermont, Oakey	5,761·25	306·929	Woodside Golden Volunteer
Ladybird of Peeramon	A. H. O. Koppen, Peeramon	5,490·75	277·367	Trinity Segunda's Prince
Meadowvale Marlene	Young Bros., Kingaroy	4,510·69	272·709	Kathleigh Standard

The Young Farmer

INTERSTATE COMPETITION.

Particulars of an Interstate Competition for teams of club members are:—

1. A Team will consist of six members, one of whom will be the Team Leader. The Team Leader to be selected by the respective Team Manager.

2. The competition will be divided into Sections. Sections A and B are designed to ascertain the stock knowledge of competitors, Section C agricultural or horticultural knowledge, or knowledge of animal huhbandry, whilst Section D takes the form of an intelligence test of powers of observation.

COMPETITION.

Section.		Points.
A.	One member to describe the appearance of a good dairy cow, and demonstrate. Time allowed, 10 minutes ..	12
B.	One member (not the member who took part in Section A) to enter cattle judging competition, in which three Jersey cows are to be placed in order of merit and their points and faults described in writing on the card provided. Time allowed, 15 minutes	20
C.	Four members (not members who took part in Section A or Section B) to give an instructional or demonstrational lecture on some phase of agricultural or horticultural work or animal husbandry (excluding dairying) of his own choosing. Each member to work individually. Time allowed, 5 minutes each member	48
D.	Each member to visit one of the following sections of the Show and prepare an address describing the important features of the section visited. Each team to decide amongst itself which boy is to visit which section, but not more than one member of a Team to visit the same section. Addresses may not be read, but reference may be made to notes. The Sections:—Court of the Department of Agriculture, Junior Farmers' Exhibit, Metropolitan Meat Industry Board, Agricultural Implements, Poultry Pavilion, Districts Exhibits, Pig Pavilion, Bacon Exhibits, Farrer Wheat Court, Butter Exhibit, Fruit Exhibit. Time, allowed, Team Leader 10 minutes, other members 4 minutes each	20
	Total points	100

The marks obtained for all sections by each of the States are as follows:—

	Queensland.	New South Wales.	Victoria.
A.	8·0	11·0	8·5
B.	11·8	13·4	11·6
C.	43·68	34·8	30·36
D.	16·0	16·6	16·4
Total	79·48	75·8	66·86

General Notes

Staff Changes and Appointments.

Mr. T. K. Kelly, inspector of stock, Department of Agriculture and Stock, has been transferred from Ramsay to Warwick.

Messrs. F. J. Harris and J. L. F. Foran, analysts in the chemical laboratory of the Department of Agriculture and Stock, have been appointed also analysts for the purposes of the Dairy Produce Acts.

Mr. F. G. Few, analyst, chemical laboratory, has been appointed also an analyst under and for the purposes of the Fertilisers Act.

Messrs. J. W. Clancy (Maryvale), A. B. Cummings (Cairns), H. C. Scholer (Manly), H. C. Williams (Indooroopilly), H. M. Williams (Albion), A. M. Williams (Southport), and W. A. Brown (Kangaroo Point) have been appointed honorary fauna protectors and honorary rangers under the Native Plants Protection Act.

Mr. E. R. Behne, B.Sc., M.Sc.App., A.A.C.I., chief assistant mill technologist, Bureau of Sugar Experiment Stations, has been appointed mill technologist, Bureau of Sugar Experiment Stations, Department of Agriculture and Stock.

Mr. S. A. Lilliendal, Koumala, has been appointed canegrowers' representative on the Plane Creek Local Sugar Cane Prices Board, in place of Mr. C. W. Davidson, resigned.

Messrs. E. P. Noakes, R. J. Baldwin, W. Coleman, A. J. Thompson, S. D. Bolton, F. E. Eastaughffe, G. Meiers, J. W. Clayton, T. H. Coolee, and T. G. Gaydon, members of the Isis Shire Council, Childers, have been appointed honorary protectors under *"The Fauna Protection Act of* 1937."

Mr. S. L. Everist, assistant to research officer, Division of Plant Industry (Research), has been appointed assistant research officer, Agricultural Section, Division of Plant Industry (Research), Department of Agriculture and Stock.

Messrs. H. Lambert, F. C. Jorss, and R. J. Rollston have been appointed assistant inspecting cane testers for the forthcoming sugar season, with headquarters at Mackay, Maryborough, and Cairns, respectively. Messrs. Lambert, Jorss, and Rollston also have been appointed cane testers at each of the mills in their respective districts.

The undermentioned have been appointed cane testers for the forthcoming sugar season: Messrs. L. J. G. Becker (Pleystowe), C. J. Boast (Moreton), T. Breen (Inkerman), T. P. Brown (Marian), L. Chadwick (Mount Bauple), P. H. Compton (Maryborough), T. F. Corbett (Qunaba), T. D. Cullen (Gin Gin), L. G. F. Helbach (Babinda), T. Herbert (South Johnstone), J. Howard (Rocky Point), C. H. Humphreys (Racecourse), H. C. Jorgensen (Plane Creek), J. Macfie (Fairymead), S. McRostie (Tully), P. J. Phelan (Invicta), W. Richardson (Kalamia), G. Tait (Farleigh), W. Trulson (Mourilyan), R. D. Woolcock (Bingera), and V. F. Worthington (Mulgrave); Misses D. Bowder (Millaquin), E. Christsen (Proserpine), A. L. Levy (Mossman), M. A. Lyle (Pioneer), M. A. Morris (Cattle Creek), I. Palmer (Isis), E. Rowe (North Eton).

The undermentioned have been appointed assistant cane testers for the forthcoming sugar season: Messrs. R. Anderson (Kalamia), P. C. Boettcher (South Johnstone), C. Boone (Farleigh), A. Eyrne (Inkerman), L. C. J. Clifton (Fairymead), W. C. Cocking (Qunaba), J. F. Emerick (North Eton), H. J. Heidke (Proserpine), J. D. Kinnon (Tully), J. Mackenzie (Racecourse), R. A. Mahoney (Pleystowe), C. M. Martin (Millaquin), G. W. Maslen (Marian), J. H. Murtagh (South Johnstone), R. D. R. Rex (Invicta), W. P. Snewin (Isis), J. Y. Taylor (Bingera), P. A. Van Lith (Plane Creek), D. Walton (Pioneer), and S. Wilson (Kalamia); Misses A. Anderson (Pioneer), F. Atherton (Moreton), K. Backhouse (Invicta), E. A. Crees (Bingera), P. G. Eadie (Tully), F. Foubister (Racecourse), N. Hooper (Fairymead), M. H. Makings (Moreton), (Mrs.) M. E. Nally (Babinda); K. M. O'Brien (Plane Creek), M. Osborne (Mourilyan), E. M. O'Sullivan (Maryborough), P. Southwick (Mulgrave), P. Thorburn (Millaquin), P. M. Watts (Proserpine), M. Whitla (Marian), and S. Wilkinson (Farleigh).

Mr. F. W. Schumann, Dalrymple Heights, has been appointed an honorary protector of fauna.

Constable W. M. McNaught, Mackinlay, has also been appointed an inspector under the Slaughtering Act.

Stallion Boards.—The following have been appointed members of stallion boards:—

Darling Downs North District Stallion Board.—J. C. J. Maunder, B.V.Sc. (Chairman), Government Veterinary Surgeon, Brisbane, W. C. Jeffery (Shirley, Miriam Vale), E. Cox (Paddington).

Darling Downs South.—A. R. Nott, B.V.Sc. (Chairman), Government Veterinary Surgeon, Brisbane, W. O. Scott (Hornet Bank, Taroom), W. Frood (Toowoomba).

West Moreton.—A. R. Nott, B.V.Sc. (Chairman), T. MacDonald (Wooloowin), D. Jackson (Teneriffe).

Wide Bay.—R. D. Chester, B.V.Sc. (Chairman), Government Veterinary Surgeon, Murgon, T. Turkington ("Wattle Brae," Pilton), H. S. Handley (Culverthorpe, Pampas).

Burnett.—R. D. Chester, B.V.Sc. (Chairman), T. Turkington, H. S. Handley.

East Moreton.—J. C. J. Maunder, B.V.Sc. (Chairman), W. O. Scott, D. Jackson.

Central Coast.—M. R. Irving, B.V.Sc. (Chairman), Government Veterinary Surgeon, Rockhampton, J. L. Bowman (South Brisbane), E. Cox.

Northern Coast.—M. R. Irving, B.V.Sc. (Chairman), J. H. Wall (Rockhampton), T. MacDonald.

Northern.—R. E. Churchward, B.V.Sc. (Chairman), Government Veterinary Surgeon, Oonoonba, T. Garrard (Woolloongabba), W. Frood.

The appointment of Mr. N. E. D. Arthur as acting inspector of stock at Tibooburra, New South Wales, has been cancelled, and Mr. F. F. Forster, inspector of stock, Tibooburra, has been appointed to be also acting inspector for Queensland.

The appointment of Mr. H. H. Griffiths as acting inspector of Stock at Habnarey Gate has been cancelled, and Mr. B. B. Brett has been appointed temporary honorary inspector of stock at Habnarey Gate.

Mr. R. D. Hogarth (Durah North, Chinchilla) has been appointed an honorary inspector of stock.

Changes have been made in the personnel of local sugar cane prices boards as follows:—

Mr. P. M. O'Connor, Clerk of Petty Sessions, Gordonvale, has been appointed chairman of the Mulgrave Local Sugar Cane Prices Board, in place of A. Anderson, Clerk of Petty Sessions, Cairns.

Mr. F. W. Blake, Clerk of Petty Sessions, Babinda, has been appointed chairman of the Babinda Local Sugar Cane Prices Board, in place of A. Anderson, Clerk of Petty Sessions, Cairns.

Mr. M. J. Waddell, Clerk of Petty Sessions, Tully, has been appointed chairman of the Tully Local Sugar Cane Prices Board, in place of C. Burchill, Police Magistrate, Innisfail.

Mr. C. R. M. Clelland, Clerk of Petty Sessions, Gin Gin, has been appointed chairman of the Gin Gin Local Sugar Cane Prices Board, in place of C. D. O'Brien, Police Magistrate, Bundaberg.

Mr. J. F. McCutcheon, Cowley, Mourilyan, has been appointed canegrowers' representative on the Mourilyan Local Sugar Cane Prices Board, in place of B. B. Ross, resigned.

Mr. D. L. Lennard, of Victoria street, Balmoral, has been appointed an honorary ranger under the Native Plants Protection Act, and an honorary protector under the Fauna Protection Act.

The planting or transplanting of maize in the Bundaberg district without a permit is now prohibited. The Bundaberg district is now a quarantine area under the Diseases in Plants Acts because of the prevalence of downy mildew disease in cane.

Mr. H. S. Iliff, previously Deputy Registrar of Brands, Department of Agriculture and Stock, has been appointed Registrar of Brands, Senior Clerk, Stock Branch, and Registrar of the Veterinary Surgeons' Board, Department of Agriculture and Stock.

Professor H. R. Seddon, D.V.Sc., of the University of Queensland, has been appointed Director of Veterinary Services, Department of Agriculture and Stock, for a period of three years.

Mr. L. D. Carey, formerly Staff Inspector, Department of Agriculture and Stock, has been appointed Chief Inspector of Stock and Chief Inspector of Slaughter-houses, Department of Agriculture and Stock.

Constable C. F. Murray, Cloncurry, has been appointed an inspector under the Brands Acts.

Mr. R. H. S. Murray, Manager of Forest Home Station, Georgetown, has been appointed an honorary inspector under the Diseases in Stock Acts, in place of Mr. L. R. Shaw, who previously held this position.

Open Season for Duck and Quail.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937" providing for an open season for duck and quail in Queensland. The effect of this is to fix the open season for duck in Southern Queensland from 1st April, 1940, to 31st August, 1940, both inclusive, and for quail in Southern Queensland from 1st May, 1940, to 31st August, 1940, both inclusive; and for duck and quail in Central and Northern Queensland from 1st July, 1940, to 30th November, 1940, both inclusive. The maximum numbers which any one person may take during a period of twenty-four hours are 20 duck and 25 quail.

Egg Board.

An Order in Council has been issued under the Primary Producers' Organisation and Marketing Acts in relation to the Queensland Egg Board, which, in effect, empowers the Board to dispense with the issue of certificates to growers whose credit in the general reserve fund of the Board is less than 10s.

No Open Season for 'Possums.

The Minister for Agriculture and Stock (Mr. F. W. Bulcock) has announced the decision of the Government not to declare an open season for opossums during the present year. Although official reports indicate that opossums are fairly plentiful in some portions of the State, the oversea markets, especially those on the Continent, are in a disturbed state. Recent sales of Australian furs were unsatisfactory and large stocks are still held in London. The Minister stressed the major transport difficulties which would have to be overcome if supplies were placed on the market, and, in view of the present international position, competition would undoubtedly be poor and restricted.

It was doubtful, the Minister added, whether trappers would be recompensed for their outlay and labour should a season be proclaimed and, in all the circumstances, the decision to continue protection for the opossum throughout the present year was fully justified.

Fauna Sanctuary near Benaraby.

An Order in Council has been issued under "*The Fauna Protection Act of* 1937" declaring the property of Messrs. C., E. P., G. S., and A. C. Colyer, in the parish of Iveragh (near Benaraby) to be a sanctuary under and for the purposes of the abovementioned Act. Mr. A. C. Colyer will act as the honorary protector for the sanctuary.

Peanut Industry.

A Proclamation under "*The Peanut Industry Protection and Preservation Act of* 1939," prohibiting the removal from growers' premises of any ungraded peanuts except for delivery to the Peanut Board, has been issued. Regulations relative to the grading of peanuts also have been issued.

Council of Agriculture.

Regulations have been issued under the Primary Producers' Organisation and Marketing Acts relative to the Council of Agriculture. These are a re-issue of existing regulations, and outline the order of business and procedure at meetings of the Council. The revision has been made following the introduction of recent amending legislation.

Production of Ginger.

The Minister for Agriculture and Stock (Hon. F. W. Bulcock), in commenting on the decision of the Buderim Fruitgrowers' Association to enlist the aid of the Federal Government in establishing the ginger industry on a proper basis, drew attention to the efforts made by his Department whereby it was hoped that the production of ginger in Queensland might be stimulated.

The annual Australian requirements are approximately 3,250,000 to 3,500,000 lb., and production, which is practically limited to Queensland, amounts to about 45,000 lb.

The production of ginger in Queensland is limited at present almost exclusively to the Buderim district, and an area of only 10 acres is under crop. To meet Australian requirements and provide seed for replanting approximately 1,000 acres would require to be cultivated, and there is an area of from 700 to 900 acres of land in the Buderim district suitable for production of the crop. In addition, other areas along the coastal parts of Queensland would be definitely suitable for ginger growing. However, as the cost of production, amounting to about 4¼d. per lb., would leave little margin of profit to the grower, the Minister considered that before any definite encouragement could be given to the stimulation of this industry it would be necessary to afford protection by way of duty in any endeavour made to meet Australian requirements through local production.

At present the major portion of the imported product is admitted duty-free, and a revision of the tariff in respect to this commodity would enable local growers to secure a reasonable return for their crop.

Mr. Bulcock stated that he had approached the Minister for Commerce some little time ago and sought advice as to what protection could be afforded to the ginger-growing industry by way of duty, and also whether the co-operation of the Department of Commerce could be secured in the direction of a general survey of the industry, with a view to taking such action as might be necessary to develop and stabilise it. So far no reply has been received to the request for this advice.

Buffalo Fly.

An extension of the buffalo-fly pest in the north-western area of the State has been recently reported, stated the Minister for Agriculture and Stock (Hon. F. W. Bulcock), in the course of a Press announcement.

The State Government recently made provision for the necessary finance to make an intensive survey of the infested area and to institute such measures as were found necessary to control the pest. A staff of experienced officers, under the direction of a Government veterinary surgeon, is now engaged on this work.

In order to protect the stock in districts contiguous to the present infested area a quarantine area was recently proclaimed into which stock are not permitted to enter unless they have been inspected and found free from the fly. Apparently, said the Minister, notwithstanding this provision, certain stock had been moved without permission from a property within the infested area to a clean area, and this movement is likely to have grave consequences if the stock were infested with the fly, inasmuch as it is calculated to spread the pest which it is hoped to control.

The Minister called attention to the fact that these irregular movements without permission constitute offences against the Diseases in Stock Acts, and any contravention of these Regulations must be regarded seriously. It is proposed, on the detection of these offences, to ask for drastic penalties.

In the interests of the cattle industry in Queensland, the Minister sought the co-operation of stockowners in adherence to the Regulations prescribing the issue of permits for all stock movements, and issued a strong warning against the movement of stock in the buffalo-fly area until the permission of departmental officers had been obtained.

Proposed Tobacco Leaf Board.

A ballot on the question of the formation of a tobacco leaf board, conducted by the Department of Agriculture and Stock, has resulted in the defeat of the proposal. Although 51.29 per cent. of the growers who voted gave an affirmative vote, it was less than the three-fifths majority necessary to carry the proposal .

Goondiwindi a Fauna Sanctuary.

An Order in Council has been issued under "*The Fauna Protection Act of 1937*" declaring Goondiwindi to be a sanctuary under and for the purposes of the Act.

Answers to Correspondents

BOTANY.

Replies selected from the outgoing mail of the Queensland Botanist, Mr. C. T. White, F.L.S.

Cluster Clover.

I.B. (Bogantungan)—

The specimen is *Trifolium glomeratum*, the Cluster Clover, a native of southern Europe, now naturalised in most of the Australian States. It is an annual species of clover, and provides a palatable fodder during the late winter and spring months, but dies off on the approach of hot weather, about the middle of November. Seed is obtainable through the ordinary commercial channels and should be sown in the autumn.

Blue Panic. Tridax Weed.

R.F. (Townsville)—

The grass is *Panicum antidotale*, Blue Panic. This grass has gained considerable favour in some parts as a fodder. The weed is *Tridax procumbens*, Tridax Weed, a native of tropical America, now naturalised in most tropical countries. It is very common in Queensland along the whole coast, and we have seen it eaten by stock on a face with other plants.

Trees and Shrubs Suitable for the South Burnett. An Excellent Tree Supply Service to Farmers.

A.J.O. (Cloyna)—

Cape Chestnut (*Calodendron capense*); Crow's Ash (*Flindersia australis*); Coral Tree (*Erythrina*); Moreton Bay Chestnut (*Castanospernum australe*) (makes a good shade tree but bears seeds in great abundance, which when eaten by stock frequently cause severe gastric trouble); Camphor Laurel (*Cinnamomum camphorum*); Jacaranda (*Jacaranda mimosaefolia*); Silky Oak (*Grevillea robusta*); Currajong (*Sterculia diversifolia*); Portuguese Elm (*Celtis sinensis*); Privet (*Ligustrum lucidum*).

The foregoing are simply suggestions and are mostly obtainable through the ordinary commercial channels. Crow's Ash and Silky Oak are obtainable from the Secretary, Sub-Department of Forestry, Department of Public Lands, Executive Buildings, Brisbane. The Crow's Ash particularly is a very handsome tree and is indigenous to your locality. Other trees the Forestry Department supply are Hoop Pine, Bunya Pine, Mexican Cypress, Arizona Blue Cypress, and Mexican Pine, all of which should do well around Cloyna. The price to farmers is 5s. 6d. a dozen for plants in tubes, plus freight. The Forestry Department also has a system of sending out lots of trees of the one sort to farmers—price for tubed plants, 5s. a 100, together with cost of tubes, packing, and carriage to rail. If you want further particulars about them, we would advise your getting in touch with the Secretary of the Sub-Department of Forestry.

Regarding shrubs, following are a few suggestions:—*Habrothamnus elegans*, flowers red; *Hibiscus*—there are several sorts of Hibiscus in cultivation. If your winters are very severe, you would probably find that the syriacus or deciduous type would do better than the evergreens. *Lagerstroemia*, Crepe Myrtle, is more a small tree than a shrub and is obtainable in a variety of colours; *Abelia*, flowers pink and white; *Abutilon*, flowers red and yellow; *Brunfelsia* or *Franciscea*, the latter is the name usually used by nurserymen—flowers blue, fading to white; the mixture of blue and white flowers is rather pretty on the shrub and it is very hardy; *Cassia Candolleana*, flowers yellow; *Deutsia*, flowers white; *Dombeya*, flowers white; Oleander, flowers of various colours; there is also a variety with variegated leaves; *Murraya*, sometimes called Mock Orange, flowers white; *Raphiolepis*, Indian Hawthorn, flowers white; *Rondeletia amoena*, flowers pink; *Tecoma capensis*, flowers red. All are fairly hardy plants and should be obtainable through the ordinary commercial channels.

Rural Topics

Land Girls on the Job.

The Women's Land Army, an outgrowth of war time conditions in England where farm work is regarded more than ever as a key industry, is already justifying its organisation by the efficiency of its willing units. Some excellent tractor drivers have been turned out from the training farms, and, extraordinary as it may seem, many of the girls have shown an unexpected flair for mechanics. As a case in point, twelve girls had a three weeks' tractor course after which most of them were recommended for employment as tractor drivers capable of driving, ploughing, and setting out a normal field, while some of them were capable of doing all running repairs, including decarbonising and grinding in valves.

This represents obviously a great achievement, reflecting credit on the instructors as well as the girls who came from all sections of society. It shows, too, that women are keen on pulling their full weight in war time. Besides all that, their keenness to learn and help in the production of necessary food for the nation is a great social leveller.

Those of us who have cause to remember with affection the women of war time Britain in 1914-1918 know that our women will never be found wanting in any national emergency.

The Farmers' Feathered Friends.

One of the best controls of the plague grasshopper is the ibis, and because of this a ''Spare the Ibis'' campaign has been launched. The same applies to many other birds which feed on insect pests and so become a very important factor in our agricultural economy. The Government has very wisely proclaimed bird sanctuaries in every part of the State, and farmers and graziers are fully awake to the necessity of seeing that in all these places the rules of the sanctuary are observed.

The ibis particularly is of untold value in grasshopper control as every farmer in the districts threatened by the ''hopper'' plague last summer knows. To destroy an ibis is to reduce the effectiveness of the continuous campaign against insect pest which every primary producer has to wage.

Other valuable birds in grasshopper control are the plain turkey (which is totally protected throughout the State), starlings, and the much despised crow; but the ibis is by far the most valuable.

Grasshopper control in recent weeks has meant the saving of many crops, and in all his activities the farmer has found the ibis and other insect-eating birds very effective allies.

Drought Feeding of Sheep.

Molasses as a source of energy—and even poor-grade straw when there is a total lack of other fodder for sheep in a dry time—is recommended by the Council for Scientific and Industrial Research.

When its present investigations into stock nutritional matters and the feeding value of fodder crops are completed, the Council will draft a comprehensive drought-feeding scheme by which it will be a simple matter to select the cheapest possible rations from a number of available foodstuffs on a fluctuating market.

Molasses will have an important place in such a drought-feeding scheme because of its capacity to bind other ingredients together, its capacity to provide easily accessible energy for the sheep, and its other nutritious contents. Consequently, the nutritive value of molasses is being studied in detail.

When there is a total lack of ordinary feed, the provision of suitable energy-producing feeds is obviously a major problem in the pastoral industry, both in respect of the first cost of the foodstuffs and their transport. Conservation of fodder is, of course, the plain remedy where possible, and even poor-grade straw has about half the value of maize for this purpose. The economic feasibility of chemical treatment of straw to double its net energy value to sheep is being carefully considered.

Clydesdales Come Back.

Breeders who have kept their faith in the draught horse will yet reap their reward for their persistency in breeding and in improving the Clydesdale studs of the Commonwealth in spite of many discouragements.

Conditions have actually favoured the maintenance of high standards in horse breeding, because with a lessened demand more rigorous culling has been done.

Horses *versus* tractor is still a subject of vigorous argument wherever farmers meet in conference. The war with its power fuel limitations—both in respect of cost and supply—has, of course, altered the outlook of those who have small areas, comparatively, under cultivation. For the man farming in a small way, at present "the horse has it."

Farms as Gilt-edged Securities.

It is only in troubled times like the present that the man with money seems to realise that for real wealth—for something that is everlasting and tangible—he must go to the source of all life, the land. And that, judging from reports from all over Great Britain, is what he is doing now.

In most districts in the Old Country the demand for farms and estates of almost any size far exceeds the supply. It is not only those with money to invest, however, who are interested in good farms to-day, for there are enquiries on all hands from men who see a period of stability coming to farming, and who hope that the industry may remain stable even when the war is over.

This is the opinion of one buyer who has a mere £150,000 to invest, and which he is willing to risk in first-class agricultural and dairy farms:—"There is no question but that the public to-day realise that food-producing land is the finest gilt-edged security that it is possible to purchase."

A man like that would be welcomed everywhere in Queensland.

The British Farmers' War Effort.

By all accounts the British farmer has embarked on a great job of war work. In order to complete the ploughing up of an additional 2,000,000 acres in the first year of war, thousands of farmers have undertaken new commitments, and are adopting methods which, for one reason or another, they had been unable to undertake in peace time.

The response so far made by British farmers has been more than merely heartening; it has been an inspiring response in the face of many difficulties and handicaps, a response which has been but one of many proofs that the British people are determined to see this war through to victory for the free peoples.

The British Government, on its part, has wisely recognised that a higher level of prices will be necessary for farm products generally, and that farmers are perfectly justified in demanding a policy which the industry can follow with confidence and which will enable production plans to be laid for several years ahead. A balanced agriculture is the aim.

The British Government and the British farmer are active and willing partners in this task—a task which will ensure stability and confidence which are so essential to their war effort on the home food front.

Filling the Tin Can for Victory.

War and the canning industry promise to open up a "new market with almost unlimited possibilities for British farmers."

Canners as reported in "*The Farmer and Stockbreeder*" (England) are working at full pressure producing a huge reserve of foodstuffs for both the civilian population and the armed foces, and preparations are being made for factory extensions and for still bigger purchases at contract prices of various farm products, including peas, potatoes, carrots, broad beans, stringless beans, celery, beetroot, spinach, and almost every variety of fruit grown.

One factory alone buys the output of 3,000 acres of peas, besides other products. Yet even if the present supply of every operating canning factory were doubled, there would not be enough to meet the demand.

Negotiations are in progress between the British National Farmers' Union and the canners on the question of contract prices. It is probable that the British Government will be asked to give some form of protection to the industry, and on the farming side it will, of course, be necessary to ensure that capital so invested in specialised production will not be lost when the war is over.

Something Like a Ploughing Match.

Here are some of the details of a ploughing match in Ontario in Canada.

"The match lasted for four days and there was an aggregate attendance of more than 100,000 people. The competitors numbered over 600, including walking and riding, with horse and tractor. The visitors included the Governor-General, Lord Tweedsmuir, who himself is a no mean ploughman, and who demonstrated his prowess before an admiring throng."

We all remember the late Governor-General of Canada, who died recently, better as John Buchan, the author of many great yarns. The man who wrote books like he did *and* do a job of ploughing was the sort of man to whom we would all lift our hats.

The British Breakfast.

Experts claim that 24,000,000 rashers of bacon are consumed every day at British breakfast tables. Only a few years ago Empire bacon in the United Kingdom was notable for its absence from anything like a fair proportion of British homes. Denmark was the great provider; Sweden and other Baltic countries Holland, Poland, and other suppliers sent enormous quantities of bacon to Britain and the Empire countries were nowhere in the race.

Under present conditions Queensland pig raisers are awake to the great opportunity offered by the export trade.

Wealth in the Rubbish Bin.

Millions of tons of town refuse which go to waste in peace time are to be salvaged for the benefit of war time agriculture in Great Britain. Plans for the collection and disposal of waste have been made. The Ministry for Supply has appealed to all local authorities to turn their dust bins into a source of wealth instead of a symbol of waste. The authorities, it is pointed out, will not only serve a useful national purpose by providing an auxiliary supply of pig and poultry foods and other products, but also will add to their own revenues.

Plans also are being prepared for the greater utilisation of town refuse as a fertilizer. One farmer who farms in a very big way in the Old Country, and who uses "dust bin" fertilizer on his own farms, estimates that the rubbish of English towns amounts to 13,000,000 tons a year. This wasted fertility, he told his district farmers' club in January, could, at 10 tons to the acre, increase Britain's grain yield by 50 per cent. on a four-course rotation—manuring once in four years.

War Time Agriculture in Britain.

The British farmer is hoping that a point which is fundamental in a policy of agricultural expansion to meet war time needs shall not be overlooked by the British Government. The point is that crops must now be grown on land which, in normal times, would not pay to cultivate. This means that if crops are to be grown on marginal land, prices should be adjusted accordingly, because of the extra cost involved, as measured in terms of lower yield.

Variation in soils and circumstances must always be taken into account in any planned policy of production. In Britain, as in Queensland, or anywhere else as a matter of fact, the suitability of soils and situations for any particular crop varies. In the case of wheat, for instance, the area grown in Britain under pre-war conditions was less than two million acres—that is, the most suitable land on which wheat could be grown profitably at the prevailing prices. Accordingly, the British farmer argues that if a million more acres must be put under the plough, it must, of necessity, be on soils less suitable, and prices must make wheat a payable crop in such conditions.

It is the intention of the British Government, however, to fix prices when the time comes to ensure to farmers a reasonable return on crops to be harvested this year.

The Temperamental Cow.

Cows, in case you don't know it, are as temperamental as a star opera singer. If they don't like you, they'll lose weight or stop giving milk; if they're fond of you, they'll gain weight and cheerfully fill the bucket. From England has just come a story of a cow which overcame an inferiority complex and, consequently, developed into a record milk producer. The farmer who stepped up her production explains it this way: "I caressed her and fussed over her, and, presto, her inferiority complex vanished."

Polled Merinos—Queensland Breeder's Success.

"The polled merino ram is a distinct improvement on the horned type. It doesn't waste its substance growing a head gear that is useless and may actually be detrimental; it is less troubled by blowflies, and is much more easily handled."

That is the opinion of Mr. A. E. O. Iker, of Euneeke, who has been breeding polled merinos at Springsure for twenty years.

"When I decided to try my hand at evolving a hornless strain," said Mr. Iker in an interview recently, "my friends laughed at the idea and said I was only wasting my time. The merino had been horned so long, they said, that any stock I bred were bound to throw back to their ancestors. Knowing what had been done with cattle, I considered the experiment well worth while, and, to my surprise, the first mating with ewes from the ordinary horned strain produced twenty per cent. of poleys."

As Mr. Iker went on with his breeding, he became more than ever convinced that he was on right lines. If hornless cattle were an improvement, polled rams must be more so, for the size of a ram's spiral horns are altogether out of proportion to both his carcase and his strength—that is, when comparing him with a bull.

Blowflies had not worried him—in fact, Mr. Iker said that freedom from blowfly attack is one of the greatest virtues he claims for his sheep. Nor has he to worry about his rams getting hooked up in a wire fence, or about mis-shaped or in-growing horns. On the shearing board, too, they are easier to handle.

From his numbered ewes, he gets about ninety per cent. of polled rams.

It is too early yet to say if the elimination of horns has any appreciable effect on the size of the sheep or the weight of the fleece. He had to do a lot of in-breeding to get as many generations away from horns as possible, and, at first, there were few polled sheep to select from. Even now the numbers are very small in comparison with horned stock.

Now that horns have been largely eliminated, Mr. Iker shall be able to give more time to the general improvement of his polled sheep. The polled sheep, he says, are very good doers, and, in spite of so much in-breeding, they have not lost constitution. Nor has the wool deteriorated in any respect from the high standard set up by the parent flock. The demand for polled rams is much greater than the supply, he finds, but, as his special rams throw about fifty per cent. polls from ordinary ewes, the supply of hornless rams could be easily increased by mating them with good hornless stud ewes.

Give 'Em Beans!

Farmers in the Old Country are again relying more on home-grown beans for feeding to farm animals. This reversion to old practice will mean a lot to the stock owner in war time. Before farmers had heard of such things as protein equivalents they grew four times the quantity of beans they now produce, and imported concentrates were hardly known. The shipping situation, as in the last war, has compelled attention to home-grown fodder crop possibilities in Great Britain.

Formerly, beans were grown for two purposes: firstly, to combine with cereals and other home-grown foodstuffs to make a balanced ration for livestock; and, secondly, to act as a cleaning and restorative crop in rotation. Although farmers of those days knew nothing about "protein equivalents," they knew when their animals were "full o' beans," when they had more zest for work and were good for an extra gallon or two of milk.

The old-timer was well versed in "the science of frugality" and ways of avoiding unnecessary expenditure. He tilled the soil thoroughly on a sound rotation system which kept the land clean and in "good heart." On the heaviest soils it was beans, wheat and bare fallow, and on lighter soils roots, barley, clover, wheat, with beans replacing half the root crops and at other times half the clover—thereby lengthening the intervals between successive crops of roots and clover and safeguarding their general health.

Now, after "wandering for years in the wilderness," spoon-fed with "manna" brought from overseas, the British farmer is compelled by force of circumstances to "plough for victory."

It is calculated that one acre of a good crop of beans should provide the third gallon for four cows for six months, so that ten acres should be sufficient for a herd of 40 cows. At that rate, in the present national emergency, it is no wonder that farmers in war-time Britain, when it comes to feeding stock, are out to "give 'em beans."

The Many Uses of "Live Wire" Fences.

Farmers have shown remarkable ingenuity in adapting the electrified fencing idea to a variety of uses. That is the opinion of American research workers who made a study recently of the relation of electricity to agriculture.

In their report they say that not only are farmers using this cheap fencing for confining stock to pastures, but they are adjusting their electrical equipment to keep pigs from rooting under ordinary woven-wire fences; to prevent vicious horses or bulls from breaking down their stalls—an electrically charged wire running round the inside of the stall was sufficient; to train horses or cows to keep away from barbed wire fences, eliminating wire cuts; to keep stock from running off a scale platform while being weighed; to protect flower beds from both two-legged and four-legged marauders; to fence ditches, creeks and odd corners quickly and cheaply with a portable fence; to stop horses from halter pulling by stretching a ''hot'' wire behind them; to prevent the spread of Bang's disease by preventing cows from rubbing noses across the fence with cows in a neighbouring paddock; to keep dogs and other animals away from fowl-houses at night; to break pigs from chicken-eating by fastening the shock end of the wire to a dead chicken and placing it in the pig pen; to break stock from jumping fences by fastening a short chain around the animal's neck which contacts the wire if the animal attempts to jump.

One of the strangest uses found was the construction of an electrified poker, used in loading cattle or driving them around in stock yards. One farmer is planning to ''fix the rabbits'' by stretching an electrified wire around his paddocks.

A word of warning, though:—

Anyone thinking of putting electricity to these or any other uses should keep in mind that electricity is highly dangerous both to man and beast if not properly installed and used. Hooking a fence wire to an ordinary electric light wire is likely to result in serious injury, or even death to anyone contacting it. Only equipment obtained from a reliable maker and installed according to directions should be used. To the inexperienced, to play around with electricity is sheer foolishness.

Farming Does a Somersault.

The effect of the war on British agriculture has been remarkable. When the war started, farming turned a complete somersault—or, as we might put it, a regular ''sugar-doodle.'' Before that agriculture was the Cinderella of British economic activities, but it is now hailed as the life-line of the nation.

War needs, too, have altered practically every farmer's plans. One in every 10 acres must now be ploughed, and country which has been under grass for more than a century without a sod being turned is under crop this year. A thorough going policy is being formulated to bring waste lands back into production.

The problem of prices—not without its headaches for many producers—is being tackled resolutely in order that the farmer may have a fair go. With many commodities, prices have already been fixed with an eye to cutting out, as far as possible, every form of profiteering.

County agricultural committees have been established and are operating in every part of the country. All the members of these committees are practical men with a close knowledge of local conditions, and upon them the Government has placed the responsibility of seeing that the utmost use is made of Britain's broad acres.

Swift changes have already taken place in the rural life of Britain. Farm wages are rising, horses have increased tremendously in value, and the village blacksmith has come into his own again—reconditioning wagons, drays, and other horse-drawn vehicles which are to be seen in ever-increasing numbers on country roads.

The auctioneer is missing from the fat stock sections of the country markets, for fixed prices make his services unnecessary. Increasing egg prices have given a new lease of life to poultry farms, and there is no shortage of helpers.

British agriculture is certainly coming into its own again, and, best of all, the farmers of the Old Land are meeting the sudden demands made upon their industry, enterprise, and energy, in spite of all the heavy handicaps they have had to carry in pre-war years.

Playgrounds under the Plough.

School playgrounds in some parts of Britain are going under the plough in accordance with the ''Grow more Food'' campaign. At one school in Essex, eighty of the boys have formed teams for digging, draining, and cultivating the land as part of their scholastic duties. Detailed records of progress are filed. One interesting result is that the young people are becoming distinctly land-minded.

Lamb Quadruplets.

A very rare case of a ewe giving birth to quadruplets occurred recently on a sheep property near Cadarga, New South Wales. All the lambs are living, and are being successfully reared by the mother—a Border Leicester-Corriedale crossbred ewe.

It is well known that British breeds, notably Dorset Horns, generally produce a higher percentage of lambs than pure merinos. They also produce a greater proportion of lambs than the Corriedale ewe, which generally yields more than ninety per cent., and sometimes more than a hundred per cent. drop.

Prolificacy varies remarkably in breeds, flocks, and among individual units of a flock. Instances are, however, known where breeders have improved the productivity of their sheep by making a careful selection of mothers which have succeeded in rearing twins regularly. Outside influences—climate, management, feed, and other considerations—all have a bearing on the subject.

Menace of Water Hyacinth.

It is well known what a pest water hyacinth is once it becomes established in rivers and other waterways. In the Albury district (New South Wales) farmers felt, recently, some alarm at its introduction to a lagoon by some misguided person who apparently had an idea of adding floral beauty to his surroundings. A general warning was issued against the seriousness of the calamity that might follow such an unwise action.

The appearance and rapid growth of hyacinth in places along the Murray has convinced the farmers concerned of the menace of such a water weed to irrigation settlements. Fortunately, through prompt and concerted action, it was eradicated, but not a day too soon. The lagoon at Albury has been cleaned out and a warning given to all the residents of the Murray Valley that it is a serious offence to place roots of water hyacinth in any watercourse.

One single plant has been known to spread to 700 square yards in one season. The Albury Municipal Council, which acted so promptly, had twenty-five dray loads of hyacinth taken from one lagoon, the result of six months' spread from three plants.

War Time Beef Needs.

The responsibility of producing more beef to meet the war time needs of Britain has infused new life into the stud beef cattle industry.

With beef prices made more stable by the completion of the Imperial beef contracts, a decided impetus has been given to breeding, the result of which is that good lines of herd bulls of most breeds are now at a premium.

It is true that prices for commercial and stud cattle have not reached the dizzy heights attained towards the end of the last war. Yet, with the likelihood that stud cattle importations from Britain will be cut off till, at least, the end of the war, Australian breeders are confident that the law of supply and demand will have an ultimate effect in lifting values to generally higher levels.

Making Full Use of Our Farms.

In the days before we had good roads and modern cars the farm was much more self-sufficient. Those were the days of the farm garden and orchard, when the farmer's wife kept the family fed on the produce of the farm. Now we have swung to the other extreme. It has become an age of specialisation, even with farmers. We have left off mixed farming in order to devote all our time to practically a single crop. The family fruit garden is, on many farms, no more—the vegetable garden a neglected weed patch; and some farm families eat most of the food out of tin cans. One often has to go a long way to find a farmer who has discovered the true art of living cheaply and well. It is, unfortunately, a rare sight to see a good vegetable garden on a farm. Home-grown products have become unfashionable, and the result is that many farmers wonder why their living costs are so high. By reviving the custom of our fathers and mothers in making the farm furnish more of our living, we would find that we had solved part of our economic problems and at the same time be living better. To-day, thanks to refrigeration, the farmer's wife has actually better chances of making more use of the products of the farm for her own table.

—*New Zealand Farmer Weekly.*

Farm Notes

JULY.

WHEAT sowings may now be completed in Darling Downs districts where seasonal conditions may have delayed operations because of unsatisfactory soil moisture. Early-maturing varieties, such as Florence, Novo, and Seaspray, are very suitable for late sowing, while the popular medium-early varieties Flora, Three Seas, and Pusa may also be sown with every chance of success.

Stock should be removed from early-sown wheat subjected to grazing by the end of the month, if a satisfactory yield of grain is desired.

Canary seed, which has proved suitable for the black basaltic Downs soils, may be sown during July, drilling in approximately 15 lb. sound seed per acre. Although usually harvested for seed, the crop will make excellent hay or provide useful grazing.

Potato planting will be commencing on lands east of the Main Range where late frosts are not a deterrent. Cut sets may be used, dusting the cut surfaces with wood ashes or slaked lime shortly after cutting, but whole seed not less than 2 oz. in weight is to be preferred.

Seed-borne disease can be prevented by treating with either hot formalin or with corrosive sublimate, as advised in a leaflet issued by this Department.

Old potato lands deficient in humus can be made more productive by ploughing in green manure crops, and the application of suitable fertilizers when planting.

After the harvesting of late maize, old stalks should be ploughed in and allowed to rot. All headlands will be improved by clearing up weeds and rubbish, preferably with a good fire.

Mangolds, swede turnips, and similar root crops which are making satisfactory growth, should be thinned out to suitable distances apart in order to encourage full development, while the necessary inter-row cultivation should not be overlooked. The root system of autumn-sown lucerne should now be well established, and will be strengthened by an early mowing if fair top growth has been made.

Any infestation of weeds during the spring can be kept in check by frequent mowing without regard to the quantity of hay secured. When fully established, cuttings can be regulated to coincide with the commencement of flowering.

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TO SUBSCRIBERS.

Subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

Orchard Notes

JULY.

THE COASTAL DISTRICTS.

CITRUS fruits, with the exception of the late-ripening varieties, will have been harvested by now, and cultural operations should be receiving attention.

Trees which show indications of impaired vigor will require a somewhat heavy pruning both in respect to thinning and shortening the branches. Where the trees are vigorous and healthy a light pruning only will be necessary, except in the case of the Glen Retreat mandarin. The densely-growing habit of this variety leads to a profusion of weak shoots, which, if allowed to develop, will cause overbearing with resultant small and inferior fruit at an early age.

Where trees show signs of failing, look for collar rot at or near ground level. The roots should be examined for disease, and in the North Coast districts for the citrus root bark channeller. A light application of paradichlorobenzene buried a few inches deep in circular drills around the tree and with the surface stamped firmly has been recommended for controlling this pest. The distance between the circular drills should be not more than 18 inches, and care should be taken to prevent the crystals of paradichlorobenzene from coming into contact with the roots. It may be necessary to repeat the application after an interval of three or four weeks.

Where it is necessary to control brown spot of the Emperor of Canton mandarin, black spot, melanose, and scab, the fungicide should be applied at the correct time. The control measures recommended are—

For Brown Spot.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall (i.e., as soon as the majority of the fruit has set).

(2) Two months later.

(3) In late February.

For Black Spot.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall.

(2) Two months later.

For Melanose and/or Scab.

Home-made cuprous oxide mixture (3-80)—

(1) At ½ to ¾ petal fall.

Certain applications of these copper sprays may be combined with various insecticides and mixtures to correct mineral deficiencies, such as zinc. Information regarding these mixtures can be obtained from this Department.

Where for any reason healthy trees of vigorous constitution are unprofitable, they may be headed back—in fact, have the whole of the top removed—leaving a few selected arms. All other branches should be cut away at their source of origin. The three or four remaining arms, of which lengths will vary from 2 to 4 feet, will form the future framework of the tree. Care must be taken to cover the whole of the exposed bark with a suitable coating of whitewash to prevent sunburn. The numerous shoots which will grow from main arms should be suitably reduced, leaving from two to four on each arm. Under favourable conditions, these will be in a fit condition to receive selected buds from desirable trees by the following autumn. It is desirable that when shoots intended for budding have attained a length of from 6 to 9 inches, their terminals should be nipped off in order to stiffen their growth and guard against the possibility of damage by strong winds.

Fertilizing should be finished as early as possible, the mixture for the spring application being high in readily available nitrogen. Ploughing should then be completed, the depth being regulated by local conditions and the nature of the original preparation of the land. After the ploughing, the land should be worked down to a fine state of tilth. On hillside orchards, attention should be given to the control of possible storm waters. Cultivation should be so arranged as to form shallow drains or banks along the tree rows and across the heaviest slope, leading into suitable side drains which may be grassed to prevent erosion.

The planting of trees may be continued and, with the exception of custard apples, expedited. The attention of citrus growers should be confined to varieties suited to their local conditions.

The pruning of grape vines should be completed, and where cuttings for planting are required these should be selected, trimmed, and heeled-in in slightly dry soil. Canes intended for cuttings should not be allowed to lie about and dry out, but should be treated the day they are severed from the plant. Cuttings are frequently made too long. From 10 to 12 inches is a suitable length which allows for insertion in the soil so as to permit of the top bud, with a short section of the internode, protruding above the surface.

THE GRANITE BELT SOUTHERN AND CENTRAL TABLELANDS.

ALL pruning other than that applied to peaches and varieties which are late in coming into growth should be finished this month, and the planting of young trees, if not already done, should no longer be delayed. Early planting is preferred, the sooner after the fall of leaves the better. When there are indications of the swelling of the buds, the time is opportune for working over unprofitable trees, where the stock is reasonably vigorous. Strap grafting, as advised by the local field officers, is the most satisfactory method of top-working deciduous trees.

The pruning of vines should be postponed as long as circumstances permit, and these can only be gauged on actual observation as they are subject to much variation.

The usual winter working of the land is essential for the retention of moisture and aeration of the soil, but in shallow soils in which many orchards are planted, deep working is most detrimental. The matter of seedling stocks for apples and the inferior plants frequently received from Southern nurseries prompts a query as to how many seeds have been stratified for spring planting, and whether any effort is being made towards raising a local supply of nursery stock.

Plate 154.

A JUNGLE SHADOWED REACH OF THE GREGORY RIVER, GULF COUNTRY, NORTH QUEENSLAND.

THE HOME
and
THE GARDEN

Maternal and Child Welfare.

Under this heading is issued each month an article, supplied by the Department of Health and Home Affairs Maternal and Child Welfare Service, dealing with the welfare and care of mother and child.

BABY'S OUTFIT.

OUR article last month dealt with baby's clothing in regard to the purpose, comfort, economy, making, and laundering. This month we are going to talk to you about baby's outfit in detail.

The following articles are usually included in baby's outfit:—Binders, napkins, vests, petticoats, frocks, nightdresses, bonnets, bootees, and shawl. A full description of these may be found in the "Expectant Mother," a booklet issued at the Maternal and Child Welfare Centres, where simple patterns may also be obtained.

Binders.

The binder is simply a bandage for keeping in place the dressing applied to the navel, and not a garment to support baby's back. It should be made of cellular cotton material, not flannel, and should be discarded as soon as the navel has healed.

Napkins.

These should be made of medium quality turkish towelling or good quality white flannelette. A double thickness of butter muslin joined on two sides makes a soft absorbent pad specially recommended for use in baby's early weeks, or if any soreness is present. Knitted pilchers or a triangle of fine flannel may be placed over the napkin as a protector. Rubber garments should not be used.

Vests.

The woven silk and wool vests are very suitable although hand-knitted ones may be used. It is advisable to have a woven cotton or aertex singlet under the woollen one, as wool next to the skin can be very irritating, especially to baby's tender skin.

Petticoats.

These are designed to last the child from birth to the age of twelve months. They should be made of light-weight woollen material such as viyella or a soft flannel that is not too closely woven.

Dresses or Frocks.

Any light-weight material which washes well is suitable for making frocks. For winter wear Radianta, nun's veiling, cashmere, or viyella are suitable, for summer cotton voile, handkerchief linen, silk, or rayon may be used.

Nightdresses.

These are made on the same lines as the frocks, but are rather longer. Viyella or flannel is probably the best material, although in hot climates a lighter material such as Radianta may be preferred.

When train travelling or motoring in cold weather a wide sleeping bag made out of flannel or viyella provides a cosy covering for baby.

Bootees.

Usually a baby is more comfortable with bootees in cold weather and happier without them in hot weather. Babies whose feet are apt to get cold easily should wear bootees even in the summer.

Bonnets.

For a young baby knitted bonnets are very comfortable. They may be made of wool for winter use and silk or cotton for summer. If made of wool it is advisable to line them out with silk as we have seen babies with delicate skins develop a rash on the face from the irriation of a woollen bonnet. Do not pin a handkerchief to the front of baby's bonnet to place over his face when he is out. This only deprives him of air. Baby's face should be guarded from strong light by holding him in a shaded position or carrying a sunshade. Do not attach ribbon strings to the bonnet as baby will usually get them in his mouth. Fasten a short piece of ribbon to one side of the bonnet, carry it under the chin, and attach to the other side by means of a press stud. As baby sits up a bonnet or hat with a brim should be used.

Shawl.

In selecting a shawl do not choose one with a large open pattern in which baby will tangle his fingers, nor a fluffy shawl from which wisps of wool collect on his fingers and are carried to his mouth. A square of Radianta, cashmere, or wool voile bound or with scalloped embroidery at the edges makes a nice shawl particularly for indoor use.

Next month we shall talk about the clothing of baby's older brother or sister.

You may obtain information on all matters concerning infant and child welfare by visiting the nearest Maternal and Child Welfare Centre (Baby Clinic), or by writing to the Sister in Charge, or by communicating direct with the Maternal and Child Welfare Centre (Baby Clinic), Alfred Street, Fortitude Valley, N.1, Brisbane.

MILK IN THE HOME.

The keeping quality or "life" of milk is dependent primarily on the care exercised in its production and handling on the farm. The neglect on part of the householder to observe certain precautions, however, may seriously impair its keeping quality; conseqeuntly the milkman is blamed for what should really be the responsibility of the customer.

Every utensil into which milk is put adds its quota of germ life to the milk. It cannot, therefore, be expected that milk, even if produced under careful conditions and thus having a low bacterial count, will keep well if it is subsequently treated carelessly in the consumer's home. The consumer must accept his share in ensuring that this most valuable food is kept as pure as possible. In the home, the prevention of the introduction and growth of germs in milk depends chiefly on the cleanliness of the jugs or other vessels in which it is contained and the temperature at which it is held.

The cleaning of any vessel which is intended for milk requires a slight modification of the usual procedure in washing dishes and pots and other household articles. The following instructions should be observed:—

1. Rinse with cold water.
2. Wash in hot water, or hot water to which washing soda has been added.
3. Scald with boiling water.
4. Invert to dry. Cloths should never be used for drying, as they simply reintroduce numerous germs which, if favourable conditions exist, will multiply extensively in and reduce greatly the period of sweetness of milk placed in the vessel afterwards.

Any milk vessel cleaned in the way described will add very few additional bacteria to those already present in the milk on its delivery, whereas a neglected or carelessly washed container might add countless numbers. The influence of an improperly cleaned vessel in reducing the "life" of milk will be appreciated readily if it is remembered that bacteria double in number every twenty to thirty minutes at ordinary temperatures. Their multiplication is markedly restrained at lower temperatures until below 50 deg. Fahr., when it is practically suspended. The object in keeping milk as cool as possible in the home is, therefore, evident.

To preserve the freshness of milk in the home, the chief things to be done are:—

1. Use only vessels free from cracks and chips and cleansed scrupulously in the way already described. Plain vessels are preferable to those of fancy design, because of the greater ease in cleaning them.
2. Keep the milk in a cool, clean place.
3. Always cover the milk jug to exclude insects, particularly flies, as they, especially, transport numerous objectionable bacteria.
4. Since milk fat readily absorbs odours from its surroundings, milk should be kept apart from any substance possessing a penetrating odour, onions, certain fruits—such as pineapple—meats, and fish in any form.
5. Remove the jug from the door-step, or wherever it is placed, as soon as possible. See that the milk is protected from the sun, preferably in a cool, dark place.

IN THE FARM KITCHEN.

NOURISHING SOUPS.

Good nourishing soup is always welcome in winter, and there is plenty of variety to offer the family.

Stock forms the essential basis for all meat soups, such as consommé, thick soups, sauces, and gravies. Stock is the liquid into which the juices of meat and vegetables have been extracted by slow and very gentle cooking.

The nutritive and flavouring qualities of a properly prepared stock of good quality are:—Albumen, gelatine, osmazome, fat, and alkaline salts. There are four kinds of stock—meat, game, fish, vegetable. The last two are known as "maigre," as no meat is used in their preparation.

Now to prepare the stock.

Chop meat and bones into pieces, place in a large saucepan with double the weight of water to bones—say about 1 quart water to 1 lb. stock, bone, &c. Stand aside in a warm place for one hour with a little salt. By soaking for a while, the salted water draws out and dissolves the meat juices. Now bring to boiling point, slowly, of course. Skim well, then add vegetables, &c. Continue to simmer for about four or five hours.

Spinach Soup.

Well wash and drain ½ bunch spinach; place in a saucepan with a little salt, cover closely with a tight-fitting lid, and cook for 10 minutes over a very low gas. Put spinach through a fine mincer or sieve. Grate a small onion finely and add it to 2 cups milk and bring to boil. Melt 1 large tablespoon butter in saucepan, add 1 large tablespoon flour, cook a little, add hot milk, and stir until thickens. Add 1 bay-leaf and simmer for 5 minutes. Remove bay-leaf and add spinach, salt, and pepper and 2 tablespoons cream. If too thick, add a little white stock or milk.

Pot-au-Feu.

Procure 3 lb. fresh brisket and cover with cold water. Bring to boiling point very gently, skimming well all the time. Add 2 onions in which 3 or 4 cloves are stuck, 3 chopped leeks, ½ small grated cabbage, 2 stalks celery, 2 carrots, 2 turnips, 1 small parsnip, 12 peppercorns, a little thyme, marjoram, parsley, add a little salt to taste, and simmer the whole very gently for about 4 hours. Remove meat and put aside to serve as the meat course. Add more salt if necessary and 2 teaspoons chopped parsley. On the Continent, a French roll is cut into slices, and the broth poured over.

Corn Soup.

Chop 2 slices fat bacon into small pieces and fry until crisp. Remove from pan and fry 3 chopped onions in the fat which remains in the pan from the bacon. Add 1 large tin sweet-corn and 2 cups hot water; simmer for 15 minutes. Add 3 pints milk to ½ cup mashed potatoes, then add it to corn, also fried bacon. Season with salt and pepper and serve piping hot.

Onion Soup.

Peel and chop 4 large white onions and fry them in a little butter or margarine and cook for a few minutes without browning them. Add 1 tablespoon flour, stir well, then gradually add 1½ pints stock, bring to boiling point, and simmer for a few minutes. Skim well and add salt and pepper and 2 bay-leaves, and 3 celery stalks cut into fine dice. Simmer for 1 hour or until vegetables are cooked. Now add 2 cups milk and thicken with 1 dessertspoon cornflour diluted with a little of the milk. Season with a little grated nutmeg and serve with sippets of toast.

Mutton Broth.

Cut about 2 lb. scrag end mutton into joints and remove meat. Cut meat into dice, and take care to remove as much fat as possible. Put meat and bones into saucepan and cover with cold water. Add salt and bring slowly to boiling point. Skim well, then add following vegetables cut into dice:—2 onions, 2 carrots, 2 turnips, 1 stick celery, 1 cup grated cabbage (optional), 1 tablespoon pearl barley. Add pepper and a little more salt if necessary. Simmer very slowly until meat is tender. Remove bones and add 1 dessertspoon chopped parsley and serve.

ORANGES AND LEMONS.

Here are some new ideas for using citrus fruit in dessert courses:—

Orange Charlotte Russe.

Take 6 oz. sponge fingers, ½ packet lemon jelly, 1 orange.

For the filling: Take 2 oranges, 1 oz. gelatine, 2 eggs, ¾ pint milk, 2 oz. sugar, 1 gill cream.

Peel one orange, divide it into sections, and remove the pith. Dissolve the jelly in half a pint of hot water. Rinse a cake-tin in cold water and pour in enough jelly to cover the bottom. Let it set, and lay on it a circle of orange sections with three in the middle. Pour on a few spoonfuls of jelly to keep the orange in place, and let it set, then pour on the rest of the jelly. Cut the sides of the biscuits straight and make them all the same length. When the jelly is firm, arrange the biscuits standing in it side by side all round the tin. To make the filling, grate the rind of one orange and put it in a double saucepan with the eggs and sugar. Whisk with an egg-whisk and add the milk. Stir the custard till it is thick enough to coat the back of the spoon. Let the custard stand where it will keep warm. Squeeze the juice from the oranges on to the gelatine and add half a gill of cold water. Dissolve the gelatine slowly over a low gas, stirring all the time, and when cool strain it into the custard. Whip the cream and add it to the mixture when quite cold. Stir as it cools, and when it thickens (but not before) pour it into the prepared tin. When set, dip for a moment into hot water to loosen the jelly from the tin. Place a dish on top, turn upside down, and shake very gently.

Orange Mould.

Take 1½ level tablespoonfuls cornflour, 3 large sweet oranges, 1 oz. sugar, ½ pint water.

Squeeze all the juice from two of the oranges and peel the other, dividing it into sections and removing the pith. Mix cornflour and sugar smoothly with the orange juice. Boil the water and pour it on the mixed cornflour, stirring well. Pour back into the pan and boil for ten minutes, stirring all the time. Rinse a half-pint mould or basin in cold water and pour in the mixture. When cold and set, turn out carefully and decorate with orange sections. Sufficient for two persons.

Orange Sponge Custard.

Take 1 tablespoonful butter, ½ cup sugar, 1 tablespoonful self-raising flour, juice 2 oranges, rind of one, 1¼ cupfuls milk, 2 eggs.

Cream the butter and sugar, add the flour, orange rind (grated), and juice, and mix well. Add the milk, mix well again, and stir in the beaten egg-yolks. Whip the egg-whites to a very stiff froth and fold in last mixing lightly. Pour into a fireproof dish and bake as ordinary custard, standing in a dish of water. It will cook with a firm, light, spongy top and a creamy custard underneath.

Lemon Meringue Pudding.

Take 4 oz. breadcrumbs, 2 oz. butter, 2 oz. castor sugar, 2 eggs, ½ pint milk, rind 1 large lemon.

Bring the milk to boiling point, and pour over the crumbs; leave until cool, then with a fork mix in the butter, sugar, and grated lemon rind. Separate the yolks from whites and stir the yolks into the pudding mixture, beating the whites to a stiff meringue, ready for when the pudding has been cooked. When the meringue is piled on top, sprinkle with sugar, and return to the oven for about five minutes to set it firmly. Time to bake the pudding mixture, about twenty minutes.

Lemon Dumpling.

Take 6 oz. grated suet, 8 oz. fine breadcrumbs, 4 oz. brown sugar, grated rind and juice 2 lemons, 1 egg, ½ pint milk.

Make the milk hot, and pour it over the crumbs. When cool, beat in the grated suet, lemon rind, sugar, and beaten egg, with a pinch of salt. Fill buttered cups, tie down with greased paper. Cook in a steamer for one hour. Turn out and serve with a transparent sauce made with the juice of the lemons, a little water, and butter, thickened with a teaspoonful of cornflour and sweetened with sugar to taste.

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF APRIL IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING 1940 AND 1939, FOR COMPARISON.

Divisions and Stations.	Average Rainfall.		Total Rainfall.	
	April.	No. of years' records.	April, 1940.	April, 1939.
North Coast.	In.		In.	In.
Atherton	4·14	39	3·45	3·87
Cairns	11·08	58	9·00	10·09
Cardwell	8·60	68	3·79	7·70
Cooktown ..	8·76	64	4·07	15·82
Herberton ..	3·69	54	2·28	2·78
Ingham	7·50	48	4·63	15·40
Innisfail	19·71	59	15·40	22·98
Mossman Mill ..	8·04	27	..	13·69
Townsville ..	2·55	69	1·46	1·75
Central Coast.				
Ayr	2·37	53	20·62	0·24
Bowen	2·63	69	17·52	1·54
Charters Towers ..	1·47	58	1·47	2·36
Mackay P.O. ..	6·07	69	10·62	9·81
Mackay Sugar Experiment Station	4·64	43	10·10	9·37
Proserpine ..	5·67	37	17·93	11·26
St. Lawrence ..	2·72	69	1·32	2·45
South Coast.				
Biggenden ..	2·18	41	1·10	3·31
Bundaberg ..	3·26	57	1·48	3·27
Brisbane	3·76	88	0·50	4·47
Caboolture ..	4·48	53	2·86	5·91
Childers	2·88	45	1·26	3·99
Crohamhurst ..	6·64	47	5·55	9·20
Esk	2·99	53	0·34	3·59
South Coast—contd.	In.		In.	In.
Gatton College ..	1·90	41	0·51	2·45
Gayndah	1·49	69	0·41	3·38
Gympie	3·43	70	1·69	4·35
Kilkivan	2·25	61	0·93	3·21
Maryborough ..	3·84	69	1·39	3·16
Nambour	6·14	44	3·78	8·27
Nanango	1·96	58	0·91	3·60
Rockhampton ..	2·53	69	1·97	1·77
Woodford ..	4·60	53	2·98	5·29
Central Highlands.				
Clermont ..	1·58	69	1·74	2·94
Gindie	1·14	41	..	1·53
Springsure ..	1·52	71	0·80	2·26
Darling Downs.				
Dalby	1·41	70	0·31	3·03
Emu Vale ..	1·39	44	0·26	1·86
Hermitage ..	1·36	33	..	..
Jimbour	1·41	52	0·91	3·16
Miles	1·48	55	0·35	2·47
Stanthorpe ..	1·76	67	0·20	2·87
Toowoomba ..	2·62	68	0·63	3·50
Warwick	1·65	75	0·07	3·00
Maranoa.				
Bungeworgorai ..	1·08	26	..	0·80
Roma	1·28	66	0·77	2·16

A. S. RICHARDS, Divisional Meteorologist.

CLIMATOLOGICAL TABLE—APRIL, 1940.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Mean Atmospheric Pressure, at 9 a.m.	Shade Temperature.						Rainfall.	
		Means.		Extremes.					
		Max.	Min.	Max.	Date.	Min.	Date.	Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·89	84	73	90	7	63	19	407	17
Herberton	..	74	65	81	8, 9, 10	50	17	228	21
Rockhampton	30·05	82	65	87	11	51	18	197	8
Brisbane	30·14	78	61	84	1	51	18	50	9
Darling Downs.									
Dalby	30·13	79	53	87	1	37	18	31	5
Stanthorpe	..	72	49	85	1	30	18	20	3
Toowoomba	..	71	54	79	1	40	17	81	7
Mid-Interior.									
Georgetown	29·93	90	65	92	1, 3, 4, 9, 11-14, 18, 26, 27, 30	53	17	12	2
Longreach	30·03	87	60	94	7	47	15	4	1
Mitchell	30·10	80	55	87	12	38	17	150	2
Western.									
Burketown	29·94	88	68	94	6	56	17	193	5
Boulia	30·03	86	62	97	8	48	18	217	2
Thargomindah ..	30·05	84	61	97	6, 7, 10, 12	45	17	148	3

23/P

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	June, 1940.		July, 1940.		MOONRISE. June, 1940.	MOONRISE. July, 1940.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
1	6·35	5·5	6·44	5·8	a.m. 1·57	a.m. 2·23
2	6·36	5·5	6·44	5·9	2·48	3·17
3	6·36	5·4	6·44	5·9	3·39	4·12
4	6·36	5·4	6·44	5·9	4·34	5·7
5	6·36	5·4	6·44	5·10	5 29	6·2
6	6·37	5·4	6·43	5·10	6·24	6·54
7	6·37	5·4	6·43	5·10	7·18	7·43
8	6·38	5·3	6·43	5·11	8·10	8·31
9	6·39	5·3	6·43	5·12	9·0	9·14
10	6.39	5·3	6·42	5·12	9·48	9·54
11	6·39	5·3	6·42	5·12	10·33	10·39
12	6·39	5·3	6·42	5·13	11·15	11·22
13	6·40	5·4	6·41	5·13	11·56	p.m. 12·5
14	6·40	5·4	6·41	5·14	p.m. 12·38	12·51
15	6·41	5·4	6·41	5·14	1·21	1·39
16	6·41	5·4	6·41	5·15	2·5	2·30
17	6·41	5·4	6·40	5·15	2·53	3·23
18	6.42	5·5	6·40	5·15	3·44	4·18
19	6·42	5·5	6·40	5·16	4·37	5·14
20	6·42	5·5	6·40	5·17	5·32	6·9
21	6·42	5·5	6·39	5·18	6·29	7·3
22	6·42	5·5	6·38	5·18	7·24	7·56
23	6·43	5·6	6·38	5·19	8·19	8·48
24	6·43	5·6	6·38	5·19	9·13	9·39
25	6·43	5·6	6·38	5·20	10·6	10·30
26	6·43	5·6	6·37	5·20	10·58	11·22
27	6·43	5·7	6·37	5·20	11·48	..
28	6·43	5·7	6·36	5·21	..	a.m. 12·14
29	6·43	5·7	6·36	5·22	a.m. 12·39	1·6
30	6·43	5·8	6·35	5·22	1·31	2.0
31	..	..	6·34	5·23	..	2·54

Phases of the Moon, Occultations, &c.

6th June	●	New Moon	11 5 a.m.
13th ,,	☽	First Quarter	11 59 a.m.
20th ,,	○	Full Moon	9 2 a.m.
28th ,,	☾	Last Quarter	4 13 a.m.

Perigee, 15th June, at 1.0 a.m.
Apogee, 27th June, at 9.0 p.m.

Jupiter will be a brilliant object in the morning sky, rising at 2.30 a.m. at the end of the month when Saturn will precede it by about 10 minutes. Both planets and also the invisible Uranus are in the constellation Aries.

Neptune, which takes more than 164 years to complete its journey around the Sun, has moved only a very little way in Virgo.

Mercury rises at 7.34 a.m.; 57 minutes after the Sun, and sets at 5.48 p.m.,, 45 minutes after it, on the 1st; on the 15th it rises at 8.24 a.m., 1 hour 42 minutes after the Sun, and sets at 6.40 p.m., 1 hour 38 minutes after it.

Venus rises at 8.53 a.m., 2 hours 16 minutes after the Sun and sets at 7.19 p.m., 2 hours 16 minutes after it, on the 1st; on the 15th it rises at 7.58 a.m., 1 hour 16 minutes after the Sun and sets at 6.20 p.m., 1 hour 18 minutes after it.

Mars rises at 8.47 a.m. and sets at 7.5 p.m. on the 1st; on the 15th it rises at 8.29 a.m. and sets at 6.49 p.m.

Jupiter rises at 3.47 a.m. and sets at 2.57 p.m. on the 1st; on the 15th it rises at 3.4 a.m. and sets at 2.10 p.m.

Saturn rises at 4.11 a.m. and sets at 3.17 p.m. on the 1st; on the 15th it rises at 3.21 a.m. and sets at 2.27 p.m.

At midnight on 21st of June the Sun will reach its furthest limit, 23½ degrees north of the equator and with it our Winter Solstice will arrive. If we take note of the Sun's position on the western horizon it will seem to stand still for a short time, as if to take its bearings. After this we shall see it travel, slowly at first, along its southward course. "Seeing is believing" we say, but the great Astronomers, from Copernicus on, believed what they did not see and could demonstrate that the Sun is at rest and that the planets move, and how they move, around it.

So that sowing and reaping may not cease on our most favoured planet Earth it leans more or less towards or away from the Sun in its revolution from Solstice to Solstice.

5th July.	●	New Moon	9 28 p.m.
12th ,,	☽	First Quarter	4 35 p.m.
19th ,,	○	Full Moon	7 55 p.m.
27th ,,	☾	Last Quarter	9 29 p.m.

Perigee, 10th July, at 5.0 a.m.
Apogee, 25th July, at 3.0 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S., add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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